NUCLEAR SCIENCE ABSTRACTS

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GENERAL

6387 AECL-566
Atomic Energy of Canada Ltd., Ottawa.
ANNUAL REPORT, 1956-1957. 29p.

6388
SOURCEBOOK ON ATOMIC ENERGY. SECOND EDITION. Samuel Glasstone. Princeton, D. van Nostrand Company, Inc., 1958. 646p. $4.40.

As knowledge in the field of nuclear energy has increased rapidly since 1950, the year of publication of Dr. Glasstone's Sourcebook on Atomic Energy, a revised edition has been published. Beginning with the foundations of atomic theory, the growth of knowledge of fundamental particles, energy and radiation, and the structure of the atom are described. Development of the theories of radioactivity follows, and the naturally occurring radioactive series are discussed. Measurement and properties of nuclear radiation are considered. From a study of isotopes, their discovery, occurrence, and separation, the author proceeds to the construction and operation of cyclotrons and synchrotrons. The acceleration of charged particles leads to a discussion of the development of knowledge on nuclear transmutation and artificial radioactivity, the neutron, nuclear forces and structure, and nuclear fission. A consideration of utilization of nuclear energy serves to introduce a new chapter on nuclear reactors. The general aspects of reactor design, reactor types, typical power reactors, spent fuel processing, and economics of nuclear power are discussed. New discoveries in research and development are presented on the transmutation of new elements, uses of isotopes and radiation, and cosmic rays and strange particles. Radiation protection and health physics are considered in the final chapter. (J.S.R.)

BIOLOGY AND MEDICINE

6389 USNRDL-TR-204
Naval Radiological Defense Lab., San Francisco.
QUANTIFICATION OF BODY CONFIGURATION IN GEOMETRICAL TERMS. A. R. Behnke, O. E. Guttentag, and C. Brodsky. Dec. 1, 1957. 38p.

A formula is presented for the convenient translation of anthropometric measurements into geometrical relationships which in turn make possible an accurate physical description and classification of individuals. A geometrical model can be constructed which accurately represents individual body size and shape and the relationship between surface area and body volume. This model can be extended to depict interspecies relationships and hence is useful in radiobiology for interspecies comparisons. (auth)

6390
NUCLEAR MAGNETIC RESONANCE IN BIOLOGY AND MEDICINE. Erik Odeblad (Sabbatsberg Hospital, Stockholm). Z. Med. Isotopenforsch 1, No. 1, 25-40(1956) Nov.

Since the discovery of nuclear magnetic resonance, this method has shown itself to be of great importance in the study of physical chemical problems. Examples are given to show that nuclear magnetic resonance is a powerful tool in the study of numerous problems of medicine, biology, biophysics, and biochemistry. 54 references. (J.S.R.)

Radiation Effects

6391 AF-SAM-58-77
School of Aviation Medicine, Randolph AFB, Tex. and Texas. Univ., Austin. Radiobiological Lab.
INHIBITION OF POSTIRRADIATION DIURESIS BY VASOPRESSIN IN RATS. Preliminary Report. Clyde M. Williams and George M. Krise. Feb. 4, 1958. 3p.

6392 USNRDL-TR-200
Naval Radiological Defense Lab., San Francisco.
THE EFFECTS OF CONCOMITANT SUPERFICIAL X-RADIATION UPON THE LETHAL EFFECTIVENESS OF 250 KVP X-RAYS. E. L. Alpen and D. M. Jones. Feb. 12, 1958. 14p.

The effects of adding large doses of poorly-penetrating x rays to doses of 250 kvp x rays in the lethal range are described. Doses of 1000 r or 3000 r of 50 kvp radiation only slightly reduce the amount of 250 kvp radiation required to kill dogs, and that reduction can be explained on the basis of the amount of the soft x rays which reach the midline. It may be concluded that in predicting radiological hazard from mixed superficial and penetrating radiations only the penetrating dose need be measured. (auth)

6393 NP-tr-53
EXPERIMENTAL RESEARCH ON THE EFFECTS OF X-RADIATION ON THE BONE MARROW, WITH SOME REMARKS ABOUT THE X-RAY THERAPY OF LEUKAEMIA, PSEUDO-LEUKAEMIA AND SARCOMA. H. Heineke. Translated by B. Smith from Deut. Z. Chir. 6, 196-211 (1905). 18p.

6394
EFFECT OF INERT GASES ON OXYGEN-DEPENDENT RADIOSENSITIVITY. Michael Ebert and Shirley Hornsey (Hammersmith Hospital, London) and Alma Howard (Mount Vernon Hospital, Northwood, Middlesex, Eng.). Nature 181, 613-16(1958) Mar. 1.

6395
ON SOME BIOLOGICAL EFFECTS OF RADIATION. THE MACKENZIE DAVIDSON MEMORIAL LECTURE. F. G. Spear (Strangeways Research Lab., Cambridge, Eng.). Brit. J. Radiol. 31, 114-24(1958) Mar.

Problems encountered in studies on the biological effects of radiation are reviewed. The author postulates that the main factor which limits our present understanding of the reaction of living material to radiation is our ignorance of its normal processes, and this is a chief reason for casting our net as widely as possible among different materials. As our knowledge of the normal physiology of the cell grows, so will our understanding of the mechanism of the action of radiation. (C.H.)

6396
STUDIES OF INDIRECT RADIATION EFFECTS WITH SKIN GRAFTING EXPERIMENTS AND COLORIMETRIC ESTIMATIONS OF ERYTHEMA. B. Jolles and S. G. Greening (General Hospital, Northampton, Eng.). Brit. J. Radiol. 31, 136-45(1958) Mar.

In a series of experiments with small grafts of irradiated skin in rabbits the diffusible products from irradiated areas were studied and their relative importance colorimetrically gauged. The influence on the radiation skin reaction of neighboring irradiated skin areas and the influence on the reaction of the unirradiated neighborhood were also studied in a series of volunteers. The observations relative to the radiation injury and recovery factors are discussed. (auth)

6397
INFLUENCE OF TOTAL BODY X-RAY IRRADIATION ON THE IN VITRO GLYCOGEN SYNTHESIZING CAPACITY OF RAT LIVERS. A. J. Baxi and M. B. Sahasrabudhe (Indian Cancer Research Centre, Bombay). J. Sci. Ind. Research (India) 16B, 207-9(1957) Nov.

6398
INCREASED RADIORESISTANCE THROUGH HETEROSIS. Robert Rugh and Joan Wolff. (Columbia Univ., New York). Science 127, 144-5(1958) Jan. 17.

6399
ON THE QUESTION OF THE GENETIC LOAD OF THE POPULATION THROUGH THE USE OF IONIZING RAYS IN MEDICINE. PART II. MEASUREMENT OF DOSES RESULTING FROM RADIO-DIAGNOSTIC RESEARCH ON THE GONAD. Walter Seelentag, Dankwart v. Arnim, Erich Klotz, and Josef Numberger (Universität, Munich). Strahlentherapie 105, 169-95(1958). (In German)

The authors show in two chapters how the radiation burden of the German population could be ascertained by x-ray diagnostic proceedings, the generative age for men being defined up to 40, for women up to 35 years. From statistical material on admissions of patients to hospitals in Bavaria, their sex and age, research data from the Institute for Physical Therapy and Roentgenology at Munich University and from measurements of the gonad dose of 698 male and female patients, they calculate the load of the adult population at 165 mr per head or 3.9% of the natural background. The load of female gonads generally is much higher than that of men. (auth)

6400
RADIOINDUCED CANCER OF RAT TAILS. Ernst Stutz and Ursula Bluthgen (Der Universitat Freiburg/Br.). Strahlentherapie 105, 278-95(1958). (In German)

The rat tail proved to be a particularly suitable object for generating cancer by fractionated roentgen-irradiation. At that, the canceration was no mere effect of summation; more important than the total dose for the origination of the cancer were size and distribution time of the individual doses. Tail carcinomas arose only when the tissue showed signs of radioerythema and radioinflammation and was subjected to additional irradiation. Radioerythema and radioinflammation are conditions which increased susceptibility of the tissue not only towards necrotizing, but also towards cancerogenic, irradiation effect. The tail-carcinomas always arose on the site of precanceroses existing long before in the form of atrophy and hyperkeratoses. The carcinomas arose from hyperkeratoses or more frequently in the closest neighborhood of radionecroses and ulcerating tissues. The cancerogenic ray dose is a sublethal dose. In regard to radiation susceptibility, the Wistar rats exhibited great differences. In radiotherapy of young persons, irradiations of erythematous or inflammatory tissues should be avoided. (auth)

6401
REACTION MECHANISM OF X-RAYS. Johan Bárány (Krankenhaus des Bezirksrates in Veszprem, Hungary). Strahlentherapie 105, 307-14(1958). (In German)

If a roentgen-photon separates the linking electron of covalency linkage, a molecule is split. The splitting of water molecules, and the electrons set free, change the chemical milieu of cell metabolism. If a combination in the chemically highly active cell protein is disengaged, the structure is altered as well as the reaction process, and the cell is bound to die. As to the numerical estimate of the energy required to destroy a leukocyte cell, it was found that 0.1 to 16% of the protein molecules may be split, while only about every 10^6th water molecule is concerned. (auth)

Radiation Hazards and Protection

Refer also to abstract 6970.

6402 AECU-3613
Division of Organization and Personnel. Safety and Fire Protection Branch, AEC.
A SUMMARY OF TRANSPORTATION INCIDENTS IN ATOMIC ENERGY ACTIVITIES, 1949-1956. Dec. 1957. 29p. $1.00(OTS).

Transportation incidents reported in the operations of the Atomic Energy Commission and its contractors from 1949 through 1956 are summarized and illustrated photographically. Most of the incidents involved the transportation of radioactive materials. (C.H.)

6403 ITR-1464
Naval Radiological Defense Lab., San Francisco.
EVALUATION OF COUNTERMEASURE SYSTEM COMPONENTS AND OPERATIONAL PROCEDURES. Preliminary Report. W. E. Strope. Nov. 1957. 115p. Project 32.3 [of] OPERATION PLUMBBOB. $2.50(OTS).

An evaluation was made of operational characteristics of a radiological shelter. Values were determined for some countermeasures-system parameters. The operation consisted of two phases, the first involving measurements made by project personnel in a manned station having the characteristics of a high-performance radiological shelter and the second involving monitoring and reclamation operations in an area near the shelter beginning about 1 hr after burst. Data are tabulated. Photographs of equipment are included. (C.H.)

6404 ITR-1465
Naval Radiological Defense Lab., San Francisco.
FALLOUT STUDIES AND ASSESSMENT OF RADIOLOGICAL PHENOMENA. Preliminary Report. L. E. Egeberg. Nov. 1957. 39p. Project 32.4 [of] OPERATION PLUMBBOB. $1.25(OTS).

Data were obtained to evaluate the attenuation of photons, emitted from a fallout field, due to the surface roughness

of the terrain. A study was made to determine the effect of the shot tower on the fallout material. Particles for comparison were collected from two detonations of equal scaled height, one tower supported and the other balloon supported. Data on time-dependent phenomena were recorded, as were physical characteristics of the fallout material. The use of small balloons as instrument platforms and a new fallout collector were evaluated for field use. No conclusions or recommendations can be made at this time. (auth)

6405 USNRDL-TR-199

Naval Radiological Defense Lab., San Francisco.

STUDIES ON HOMOLOGOUS BONE MARROW PROTECTION IN X-IRRADIATED MICE: THE ROLE OF DONOR LYMPHOID CELLS. L. J. Cole, R. M. Garver, and M. E. Ellis. Feb. 12, 1958. 19p.

6406

THE UNITS OF RADIATION DOSIMETRY AND THEIR CORRELATION. Robert G. Jaeger. Atomkern-Energie 3, 21-7(1958) Jan. (In German)

The present conceptions on dosage and activity levels for radiology and radiation protection were briefly explained. The necessity for a rigorous differentiation of standards and physical factors affecting radiation dosage determinations are stressed. Ionization methods still form the physical basis for exact dosage determination and standard dosimetry. Various standards are discussed. 28 references. (J.S.R.)

6407

DECONTAMINATION TEST ON COTTON CLOTHS. P. Cohen and C. Pelletier (Centre d'Études nucléaires, Saclay, France). Énergie nucléaire 1, 24-6(1957) Jan.-Mar. (In French)

Cotton cloths, contaminated with a mixture of fission products, were treated with different detergents to determine the best decontaminating agents. Versene, a sodium salt of ethylenediaminetetraacetic acid, gave the best results. (J.S.R.)

6408

KINETIN, A CHEMICAL PRODUCT AFFECTING THE MAMMALIAN CELL DIVISION RATE AFTER TOTAL BODY X-IRRADIATION. Gustavo Cudkowicz (Istituto per Ricerche Terapeutiche «Carlo Erba», Milan). Minerva Nucleare 1, 326-7(1957) Nov.-Dec. (In Italian)

The effect of kinetin (6-furfurylaminopurine), a substance which markedly promotes cell division in plant tissues, on mitotic activity of mouse jejunum mucosa after a single total body irradiation with 100 r of x rays was studied. The intraperitoneal injection of 2.5 mg of kinetin after the exposure to x rays does not modify the value of mitotic delay, expressed in terms of number of mitoses per 100 crypts of Lieberkühn at a given post-irradiation time. Nevertheless in the mice treated with kinetin after the irradiation the recovery of mitotic activity was more active and the mitotic indexes are increased in comparison to those of the control animals. The results of these preliminary experiments are briefly discussed. (auth)

6409

PROTECTION OF FOETUSES AGAINST RADIATION INJURY. E. M. Pantelouris (Queen's Univ., Belfast). Nature 181, 563-4(1958) Feb. 22.

6410

REVIEW OF DECONTAMINATION METHODS USED IN RADIOCHEMICAL LABORATORIES. J. Siejka (Inst. of Nuclear Research, Warsaw). Nukleonika 2, 647-51(1957). (In Polish)

Trends in current research on decontamination from β and γ emitters in low activity level radiochemical laboratories are discussed. Methods for chemical cleaning and deactivation of solids are described. (tr-auth)

6411

RADIOACTIVE CONTAMINATION OF THE ATMOSPHERE BY THE FALL-OUT FROM NUCLEAR EXPLOSIONS. L. Jurkiewicz. Nucleonika 2, 657-66(1957). (In Polish)

Fresh traces of radioactive contamination from U^{235} and Pu^{239} have been found, and the effects from the nuclear and thermonuclear explosions are discussed. Tables showing the recent data on the dose of ionizing radiation received by man in various conditions are presented, and the extreme importance of systematic monitoring of radioactivity in the atmosphere is stressed. (tr-auth)

6412

WHOLE BODY X IRRADIATION AND ALLYLALCOHOL INJURY OF THE LIVER. A CONTRIBUTION TO THE STUDY OF THE RESISTANCE OF ORGANISMS EXPOSED TO X RADIATION. Wilhelm Eger and Christa Terruhn (Universität Göttingen, Germany). Strahlentherapie 105, 296-306(1958). (In German)

After administering whole body irradiations to Wistar rats, the changes of resistance to injuries of the liver by allylalcohol after different lapses of time posterior to the radiologic insults and with different x-ray doses were investigated. At a dose of 250 r, an increase of resistance after a lapse of time of 7 and 14 hours was found. It was dose-dependent, increased with the dose and reached an optimum at about 500 or 600 r after a period of 14 hours, which optimum was not essentially exceeded by increasing the doses. Small doses under 40 or 30 r caused a decrease of resistance. From the course of the resulting curve of effects the conclusion was drawn that there is a neutron irradiation range at about 40 or 50 r which causes neither increase nor decrease of resistance. (auth)

6413

THE IRRADIATION OF MICE WITH RADIOACTIVE GOLD WITH AND WITHOUT PROTECTORS. A. Herve (Université de Liège). Z. Med. Isotopenforsch. 1, No. 2, 128-31(1957) Nov. (In French)

The intraperitoneal injection of 0.5 mc radiogold in black mice (C57) caused death in 70% of the animals within 20 days. The injection of 1 mc killed all animals in 8 to 10 days. Different substances which especially protected against total radiation proved to be ineffective in a single intraperitoneal radiogold injection. Repeated cysteamine injections within 3 days gave a slight protective effect. This response was no longer present when the LD 50 was exceeded. (auth)

6414

THE EXPERIMENTAL BASE AND SIGNIFICANCE OF THE MAXIMUM ADMISSIBLE RADIATION DOSE. G. Joyet (l'Université, Zurich). Z. Med. Isotopenforsch. 1, No. 2, 135-60(1957) Nov. (In French)

A summary was made of the experimental basis and significance of the maximum permissible radiation dose. It was shown that significance may be properly attached to a maximum dose of 0.3 r per week, not because of the radiation effects on the recipient but because of the genetic effects. The genetic effects caused by modern sources of radiation—x-ray diagnosis, luminous watch dials, radiological aids to shoe fitting, and nuclear weapon tests—were calculated for the population as a whole. The special case of persons occupationally exposed to radiation was also considered. (J.S.R.)

6415

SAFETY TECHNIQUES FOR RADIOACTIVE TRACERS. J. C. Boursnell. New York, Cambridge University Press, 1958. 77p. $1.75.

Safety techniques and waste disposal procedures are described for use in laboratories engaged in work employing radioactive isotopes as tracers. A table of isotopes and their toxicity, diagrams of protective equipment, and a procedure for calculating shielding requirements are appended. 47 references. (C.H.)

Radiation Sickness

6416 NP-6436
Kyoto Univ., Japan.
STUDIES ON THE ATOMIC BOMB INJURIES IN HIROSHIMA CITY. Takehiko Kikuchi, Tadatsugu Okubo, Shinsei Nishiyama, et al. Feb. 13, 1950. 28p.

Clinical observations were made on 861 atomic bomb sufferers in Hiroshima from September 9 to September 17, 1945. From the results of the observations a description is presented of the clinical picture of atomic bomb injuries and the condition which is called "pan-hemato phthisis," or the marked destruction of hematopoietic organs observed during radiation sickness. It was shown that there was a definite relation between the distance from the bombing center and the leucocyte count, sedimentation rate of erythrocytes, and bleeding time. A summary is included of physical and chemical properties of blood, and the symptoms of the digestive, circulatory, urogenital, and other organ disturbances observed. As for the treatment, repeated blood transfusion seemed to be effective. (C.H.)

Radiotherapy

6417
TELECOBALT THERAPY OF DEEP TUMORS. E. Benassi and C. Sinistrero (Istituto di Radiologia dell'Università, and Centro di Telecobaltoterapia—Clinica Pinna Pintor, Turin). Minerva Nuclear 1, 308-21(1957) Nov.-Dec. (In Italian)

An apparatus for telecobalt therapy is briefly described, and the physical and biological properties of radio-cobalt are considered A personal method of treatment is presented and the necessity is stressed of the physical and geometrical study of the mass to be irradiated. The various techniques employed in order to obtain correct centering are described, together with a series of tables of the various plans of treatment for the various localizations. The indications of the form of treatment are considered, together with the doses and the local and general reactions. Both immediate and long term results are discussed. The fundamental problem is finally considered: total sterilization of the tumor with sufficient respect for the healthy tissues. (auth)

6418
ANNUAL REPORT OF EXPERIENCES WITH TELECOBALT THERAPY. Arduino Ratti (Istituto di Radiologia dell'Università, Milan). Minerva Nucleare 1, 332-4(1957) Nov.-Dec. (In Italian)

A report is made of the observations concerning the history—during and following treatment—of 319 patients with malignant new growths treated with a telecobaltherapy unit with an initial activity of slightly more than 1000 curies. The data referring to the blood picture, the local reactions and accidents are presented. The role of this form of therapy in the modern roentgenologic treatment of tumors is considered. (auth)

Toxicology Studies

Refer also to abstract 6459.

6419
CORRELATION OF THE REDUCING POWER OF BORANES WITH THEIR TOXICITY. William H. Hill, George J. Levinskas, and Jean M. Merrill (Univ. of Pittsburgh, Penna.). Arch. Ind. Health 17, 124-8(1958) Feb.

6420
BERYLLIUM HANDLING. REDUCING THE HEALTH RISK. R. O. R. Brooks (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Power 3, 112-14(1958) Mar.

The precautions used at Harwell for the handling of beryllium and its compounds are outlined and discussed. Building design, interior finish, air purification, protective enclosures, hazards of dry sweeping, waste disposal, and contamination checking are considered. (J.S.R.)

Tracer Applications

6421 AECU-3614
George Washington Univ., Washington, D. C.
PART I. BLOOD VOLUME DETERMINATIONS WITH RADIOACTIVE ISOTOPES AND OBSERVATIONS ON BLOOD VOLUME FLUCTUATIONS. PART II. INDEX OF CARDIAC CLEARANCE. Mar. 1958. 49p. Contract AT(30-1)-1820. $1.00(OTS).

6422
EFFECT OF AGE ON RADIOSODIUM EXCHANGE IN BONE (RAT). Gilbert B. Forbes, George L. Mizner, and Anne Lewis (Univ. of Rochester School of Medicine and Dentistry, N. Y.). Am. J. Physiol. 190, 152-6(1957) July.

On a wet weight basis, bone from young animals contains more water and chloride, and less sodium and calcium than that of the adult. In the young animal, a much larger fraction of the skeletal sodium exchanges readily with radiosodium. However, since the skeleton of the older animal has a much higher sodium concentration, the total amount of sodium per unit skeletal weight which is available for exchange does not vary appreciably with age. Sodium in bone is considered metabolically to consist of three phases: fluid phase sodium, represented by that contained in the chloride space; the exchangeable portion of the crystal phase Na; and the nonexchangeable Na of the crystal phase. Changes in the magnitude of each of these phases occurs during growth in the rat. (auth)

6423
TRITIUM TRACING. A REDISCOVERY. Nucleonics 16, No. 3, 62-7(1958) Mar.

The expanding use of tritium as a tracer is the result of three developments: better labeling techniques, more sensitive detection, and lower price. The gas-exposure procedure and simpler methods of tritium labeling are discussed. Tritium detection and the application of tritium as a tracer in the fields of biology, drugs, and petroleum engineering are considered. 40 references are given for gaseous scintillation detection method. (J.S.R.)

6424
CONCENTRATION OF CESIUM-137 BY ALGAE. Louis G. Williams (Furman Univ., Greenville, S.C.) and H. D. Swanson (Univ. of Tennessee, Knoxville). Science 127, 187-8 (1958) Jan. 24.

The adsorption-absorption of Cs^{137} by algae is of interest because Cs^{137} is one of the critical fission products in power reactor wastes and atomic weapon fall-out. It is well known that plankton takes up radioactivity in fairly high concentrations. The purpose of this investigation was to study the accumulation of Cs^{137} by fresh-water algae. (A.C.)

6425
INVESTIGATION OF A BIOLOGICAL PROTECTIVE SHIELD. PART 22. MICRO-AUTOGRAPHIC INVESTIGATION OF THE BEHAVIOR OF S^{35}-CYSTEINE. Ferdinando

Passalacqua and Ruprecht Koch (Radiologischen Institut der Universitat Freiburg/Br. und der Biophysikalischen Abteilung des Heiligenberg-Instituts, Heiligenberg/Baden, Germany). Strahlentherapie 105, 271-7(1958). (In German)

Fifteen minutes after administering S^{35}-cysteine to mice, micro autoradiographic activity is found in liver, kidney and spleen. Pancreas and thymus are free. In spleen and liver the activity is mainly limited to the nucleus, particularly in the liver but also to the mitochondrias near the nuclei. In the kidney, it is an excretory process. Sulfur is diffusely spread over the nucleus in the area of the collective tubules and Henle's loop. (auth)

6426

RADIOACTIVE ISOTOPES IN CLINICAL RESEARCH AND DIAGNOSIS. K. Fellinger and H. Vetter (Med. Univ.-Klinik, Wien, Austria). Z. Med. Isotopenforsch. 1, No. 1, 1-10(1956) Nov. (In German)

A brief survey of the applications of isotopes in the fields of clinical research and diagnosis is given. (J.S.R.)

6427

DETERMINATION OF THE INITIAL UPTAKE RATE OF RADIOIODINE BY THE THYROID BY MEANS OF TWO SCINTILLATION COUNTERS. G. Joyet. Z. Med. Isotopenforsch. 1, No. 1, 11-25(1956) Nov. (In French)

With the aid of a statistics in 222 cases, it is shown, that the initial tangent T'_0 of the radioiodine uptake curve, after intravenous injection of radioactive iodine, is the determining element for the differentiation of normal and pathological thyroid behavior. A new instrument is described with two scintillation counters, which enables the correct determination of T'_0 on the reclining patient, after an injection of 10 to 20 microcuries of I^{131}. A main counter, properly suspended with an appropriate collimator and an optical adjustment for determining the distance, measures the activity of the thyroid and the neck. A second counter enables the determination of the correction for the extrathyroidal activity, based on measurements on the thigh and around the thyroid. This correction is essential for obtaining an accurate determination of the initial uptake rate of the thyroid. (auth)

CHEMISTRY

Refer also to abstracts 6975, 6977, 6986, 6997, 6998, and 7004.

6428 AECU-3642

Bureau of Mines, Pittsburgh.

ZIRCONIUM HAZARDS RESEARCH. Summary Report No. 3655 [for] September 1, 1956 to August 31, 1957. J. A. Herickes, P. A. Richardson, M. Weiss, and G. Gelernter. Aug. 31, 1957. 58p. Contract AT(11-1)-473. $6.30(ph OTS); $3.00(mf OTS).

The sensitivity characteristics of a variety of Zr samples such as sponge, scrap, powder and process materials were studied. Of particular interest was the determination of the relative sensitivity of these materials to such stimuli as impact, friction, electrostatic discharge, and heat. A study of the zirconium–water reaction at relatively low temperature was initiated. In general, scrap and sponge were relatively insensitive to impact. Only one process material, the distillation residue, exhibited any pyrophoric tendencies in this test. As anticipated, the majority of the samples tested were somewhat sensitive to friction. The dry distillation residues and Ca-reduced Zr powders, which had frequency rates of 100% in most cases, were the most sensitive of all the samples tested. Sponge was moderately sensitive, but the variation in sensitivity could not be correlated with either particle size or chemical impurities. Neither the Zr or Zircaloy scraps in the form of chips and turnings were very sensitive. The material which proved to be most insensitive to friction was the vapor phase residue. A frequency rate of zero was noted for all the samples tested. Using a condenser discharge to heat wire samples rapidly in an inert atmosphere to a temperature well above the melting point, an attempt was made to determine the effect of stress on the pyrophoricity of Zr. It was found that the minimum energy requirements for fragmentation of a pure Zr wire are reduced by the application of mechanically induced stresses and by the addition of chemical impurities such as C and/or H_2. Although the experimental phase of the study of the zirconium–water reaction has been barely initiated, there is some evidence to indicate that pre-treatment of a sample with N_2 at elevated temperatures does promote the oxidation reaction with steam. (auth)

6429 ANL-4526(Del.)

Argonne National Lab., Lemont, Ill.

CHEMISTRY DIVISION, SECTION C-II SUMMARY REPORT FOR PERIOD APRIL THROUGH SEPTEMBER 1950. J. R. Gilbreath and O. C. Simpson, comps. Jan. 23, 1951. Decl. with deletions Feb. 13, 1957. 123p. Contract W-31-109-eng-38. $19.80(ph OTS); $6.30(mf OTS).

The effect of oxidation in H_2SO_4 on the electrical resistance of the graphite bisulfates as a function of temperature is described. An apparatus is described for the measurement of electrical resistivity of graphite rods. The effect of radiation on graphite is presented. The appearance of the V-band in KCl produced by 1-Mev electrons under various irradiation conditions is described. The absorption spectrum of KI irradiated with 1-Mev electrons at ca. 20°C is given. The penetration of 1-Mev electrons into LiF as measured by the F-center concentration is described. Thermal diffusion data are presented for radiocobalt through Ni. The self-diffusion of Ag is described. The effect of pH on the gamma-ray induced exchange of deuterium gas with water is described. The oxidation of deutero-formic acid (DCOOH) by gamma rays in aqueous solutions at a pH of 3.0 is described. The effect of sample treatment on the oxidation of ferrous sulfate in 0.8N sulfuric acid by gamma ray is discussed. The surface tension of potassium was measured by a drop-weight method. A preliminary value for the fission yield of the shielded nuclide 13.7-day Cs^{136} in fission of U^{233} was determined. Decay scheme of 43-day Cd^{115} is given. Experiments were carried out to determine the number of hard gammas per disintegration of 120-day Ta^{182} and to place these gammas in the disintegration scheme. An attempt is being made to observe the absorption spectrum of francium vapor using 20-min Fr^{233} in equilibrium with Ac^{227}. Seventeen samples of U_3O_8 were analyzed for their relative U^{235}–U^{238} content. A densitometric method is described for the determination of scandium by the copper spark method. (W.L.H.)

6430 BNL-302(Del.)

Brookhaven National Lab., Upton, N. Y.

THE THIRD INFORMATION MEETING ON HOT LABORATORIES, MAY 26-28, 1954. Decl. with del. Feb. 18, 1957. 79p. $12.30(ph OTS); $4.50(mf OTS).

Topics discussed at this conference include: the design and operation of a high-level fission product recovery pilot plant; electrical control methods applicable to remote control of fabrication processes; design of a miniature pilot plant for high-level separations processes; radiometallurgical equipment at Hanford; the preparation of kilocurie quantities of Xe^{135}, design of the Idaho Chemical Processing plant; remote control aspects of the ANP fuel irradiation

program; the organization and responsibilities of a radioactive materials laboratory; the cost of design, construction, and operation of a radioactive materials laboratory; design modifications in a lathe for radioactive machining; the performance of shielding window materials at high radiation intensity; design modifications in standard small equipment items developed at BNL; and design modifications in apparatus for the study of irradiated liquid metal fuel and breeder systems. (C.H.)

6431 CCC-1024-TR-280
Callery Chemical Co., Penna.
STRUCTURES AND MOLECULAR MODELS OF BORON HYDRIDES. P. M. Maginnity. Mar. 1, 1958. 33p. Project ZIP. Contract NOa(s)-52-1024-c.

The structures of the boron hydrides have only recently been established. The fact that boron has but three valence electrons makes the configurations of these compounds unique in many ways. With one exception, however, the boron skeleton of the known boron hydrides can be considered as related to the atomic arrangement in elementary boron and certain borides; namely, a regular icosahedron. The structures of the known boron hydrides have been reviewed, and a type of molecular model has been developed for diborane, tetraborane, pentaborane(9), pentaborane(11), hexaborane(10), and decaborane. The scheme is expandable to other hydrides, such as triborane(7) and nonaborane(15). (auth)

6432 CF-55-7-138(Del.)
Oak Ridge National Lab., Tenn.
CHEMICAL TECHNOLOGY DIVISION, UNIT OPERATIONS SECTION MONTHLY PROGRESS REPORT [FOR] JULY 1955. W. K. Eister. Decl. with deletions Feb. 14, 1957. 53p. Contract [W-7405-eng-26]. $9.30(ph OTS); $3.60 (mf OTS).

Excer-Moving-Bed Reactor Studies. UO_3-starch pellets for moving-bed conversion to UF_4 were prepared manually and in the automatically controlled pelleting equipment. Batch and moving-bed tests were carried out in a study of factors affecting the carbon content of UF_4 produced from UO_3-starch pellets. HR Fuel Reprocessing. Data are given for corrosion tests on hydroclones and corrosion loops. Tests are underway to determine the effects on evaporator operation of the corrosion products expected in the HRT-CP. Test of a thermoprobe liquid level device showed promise. Hope Project. A fumeless dissolution run was made using canned natural U slugs. A slug dejacketing device for removing the Al jackets from X-10 slugs is described. Protective coatings Amercoat-87 over Amercoat-86 prime and Amercoat-33 over Amercoat-86 prime appeared to be unaffected, other than darkening in color, after exposure to 5×10^8 r in a Co^{60} source. Metallex Process. Two chlorination runs were made. Power Reactor Fuel Reprocessing. It has been demonstrated that 316L stainless steel is soluble in molten 2S aluminum. (W.L.H.)

6433 CF-56-10-83(Del.)
Oak Ridge National Lab., Tenn.
CHEMICAL TECHNOLOGY DIVISION, UNIT OPERATIONS SECTION MONTHLY PROGRESS REPORT [FOR] OCTOBER 1956. W. K. Eister, J. C. Bresee, J. T. Long, E. O. Nurmi, and C. D. Watson. Decl. with deletions Mar. 13, 1957. 109p. Contract [W-7405-eng-26]. $16.80(ph OTS); $5.70(mf OTS).

Chemical Engineering Research. Tests were carried out with a 0.4 in. hydroclone to remove water from a 30% TBP in Amsco solvent. In the Excer Process the electrolytic cell flow system was modified, and improved product purification and dehydration was investigated. The UF_6 scrubbing column in the Fluorox Process was operated with incomplete recovery of UF_6. Column modifications are being made. Uranium(IV) fluoride was successfully fluidized with N_2 at 600°C. HR Fuel and Blanket Processing. A long term investigation of the behavior of Zr in dilute UO_2SO_4 at 300°C was started. Three pairs of leaking flanges were sealed by increasing the bolt loading and were tested through fine thermal cycles with no leaks. Dissolution of corrosion product solids in H_2SO_4 was greater than 99% of the solids added. Phosphoric acid dissolution tests on corrosion product solids were started. Stainless steels were tested in ortho and pyro phosphoric acid with no detectable corrosion. Lead showed corrosion rates of 24 to 1100 mils per year. A remote operated sampler prototype was tested. In the Metallex Process Th billets were produced with a 92% Th recovery for metallurgical evaluation. Power Reactor Fuel Reprocessing. Two hydrochlorinations of simulated STR elements have indicated that about 16 hr will be required to completely react an entire STR sub-assembly at 507°C. A digester and filter were added to the Darex flowsheet following the continuous dissolver in order to study the properties of the insoluble fines produced during dissolution. Tantalum, glass, and titanium appear satisfactory as materials of construction for the Darex Process flowsheet. Neither Inconel nor 304-L stainless steel is satisfactory for the Zircex flowsheet against UCl_3 in water or nitric acid solutions. A saw was designed for the disassembly of fuel elements. (W.L.H.)

6434 HW-50230
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PILOT PLANT FOR ANODIZING OF ALUMINUM. William B. Kerr. Jan. 15, 1958. 10p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

Aluminum is anodized industrially to provide a film which is decorative, abrasion-resistant and corrosion-resistant in certain atmospheres. At HAPO small lots of aluminum-clad fuel elements were anodized in the laboratory. From the tests under operating conditions, it was concluded that the film afforded only a slight barrier to corrosion attack, but it did help prevent damage from abrasion. After the laboratory tests had been completed it was desired to construct a pilot plant to prepare a large number of pieces. The object of this work was to study the economics of large-scale production and to prepare enough pieces for more extensive testing. This report summarizes the progress made in the design and operation of the aluminum anodizing facility. (auth)

6435 HW-53617
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
FLOWSHEET NO. 2—CESIUM ISOLATION AND PACKAGING. R. W. Wirta. Nov. 14, 1957. 6p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

A flowsheet was prepared which defines the conversion of an aqueous slurry of cesium zinc ferrocyanide into a dry cesium chloride product by the hydrolysis process. Flowsheet number 2 defines a six-step batch-type hydrolysis process for converting the slurry into a dry product for off-site shipment in bulk containers. (auth)

6436 ISC-673
Ames Lab., Ames, Iowa.
STERIC EFFECTS ON THE FORMATION CONSTANT OF METAL CHELATES OF BETA-DIKETONES. G. A. Guter and G. S. Hammond. Aug. 1955. 62p. Contract W-7405-eng-82. $1.75(OTS).

Evidence is presented which indicates that chelating ability may be greatly altered by changing the steric requirements of the ligand. A series of formation constants was measured for three beta-diketones. Thermodynamic

values could not be obtained but relative concentration constants were. The constants obtained were correlated with each other and with the basicity of the reagent toward a proton. Each correlation indicated that the formation constants for the copper chelates of diisobutyrylmethane and dipivaloylmethane were low and exhibited large separation factors. However, relatively small separation factors were found for metal chelates which do not form square planar complexes. A simple method for determining the extent of enolization of beta-diketones and the kinetics of enolization is presented. The method makes uses of spectrophotometric measurements in the ultraviolet region. Correlations were observed between the pKa of the chelating agent, the kinetics of enolization, and the kinetics of hydrolysis of corresponding esters. Variations in the pKa and enol content were explained on the basis of steric effects. A procedure for the separation of lithium from other alkali metal ions was developed, making use of the selectivity of dipivaloylmethane. The theoretical implications of this selectivity are discussed. Correlation of formation constants with a double basicity scale is reveiwed. It is suggested that when using such correlations a chelate effect be taken into account. The application of the Edward and Hammett equation to formation constants is discussed. (auth)

6437 ISC-892

Ames Lab., Ames, Iowa.

RADIOCHEMICAL STUDIES OF MERCURY AND ITS IONS IN DILUTE SOLUTIONS. Herbert C. Moser and Adolf Voigt. Mar. 1957. 71p. Contract W-7405-eng-82.

The behavior of the Hg_2^{2+} ion was studied in dilute aqueous solutions. The ion was found to be unstable toward dismutation according to the equation: $Hg_2^{2+} \overset{K}{\rightleftharpoons} Hg^{++} + Hg(aq)$. Values of 5.3×10^{-3} and 5.6×10^{-3} were measured for the dismutation constant K at 25°C by making use of a radioactive tracer technique. The solubility of Hg in several organic solvents was determined. Mercuric iodide–iodide ion equilibria were studied at 25°C. Use was made of the extraction of HgI_2 into benzene from dilute aqueous solutions of $Hg(NO_3)_2$ containing excess KI to study the following equilibria: $HgI_2 + I^- \overset{K_1}{\rightleftharpoons} HgI_3$ and $HgI_2 + 2I^- \overset{K_2}{\rightleftharpoons} HgI_4^{2-}$. K_1 and K_2 were determined to be $(5.0 \pm 0.1) \times 10^3$ and $(5.1 \pm 0.1) \times 10^5$, respectively. (W.L.H.)

6438 ISC-902

Ames Lab., Ames, Iowa.

SEMI-ANNUAL SUMMARY RESEARCH REPORT IN CHEMISTRY FOR JANUARY–JUNE 1957. Sept. 11, 1957. 67p. Contract W-7405-eng-82. $1.75(OTS).

Heat capacity measurements of yttrium were made from 15 to 350°K. Lattice constants are given for rare earth–carbon systems. Thermal analyses were carried out on rare earth fluorides to determine their melting points. The extraction of fission products with silver is discussed. A study was made of the vertical distribution of both Zr and carbon in a sample of U–Zr alloy prepared from U metal. The degree of immiscibility of U and rare earth metals was determined, and the results are given. The solubility of Hg in organic solvents at 25°C is presented. (W.L.H.)

6439 KAPL-M-MEJ-1

Knolls Atomic Power Lab., Schenectady, N. Y.

THE pH OF PURE WATER, AND OF AMMONIUM, LITHIUM, AND POTASSIUM HYDROXIDE SOLUTIONS. Merle E. Jones. Feb. 28, 1958. 19p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The calculations presented were made to compare the effect additions of bases have on the high temperature pH of the systems. The pH of pure water and NH_4OH, LiOH, and KOH solutions were calculated for the temperature range of 75 to 540°F using data available in the literature. (M.H.R.)

6440 NAA-SR-2158

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

THE PREPARATION OF DI-DEUTERO SULFURIC ACID. R. H. Shudde. Mar. 1, 1958. 7p. Contract AT-11-1-GEN-8. $0.50(OTS).

A method which can be adapted to continuous and inexpensive production of 100% D_2SO_4, by bubbling helium-diluted SO_3 vapor through D_2O, is described. (auth)

6441 TID-5254

RAND Corp., Santa Monica, Calif.

ABSTRACT COMPENDIUM ON LITHIUM HYDRIDE. Charles P. Nash. Sept. 27, 1954. Decl. Mar. 14, 1958. 42p. For Los Alamos Scientific Lab. Contract [W-7405-eng-36], Subcontract SC-9. (RM-1352-AEC). $7.80(ph OTS); $3.30(mf OTS).

6442 UCRL-3867

California. Univ., Berkeley. Radiation Lab.

BONDING AND SPECTRA OF COORDINATION COMPOUNDS (thesis). Robert Dean Feltham. June 1957. 104p. Contract W-7405-eng-48. $16.80(ph OTS); $5.70 (mf OTS).

The electron spin-resonance spectra of chromium dibenzene cation and similar compounds are used to establish the nature of the chemical bond between the chromium and the carbon atoms. These are found to be essentially "covalent" compounds, the electrons being spread out over all the atoms of the complex. The optical spectra, both visible and ultraviolet, are presented and related to the bonding and electron-spin resonance spectra. The transitions from approximately 10,000 to 2000 A are assigned in terms of molecular orbitals. A comparative study of copper acetate and of copper bisacetylacetonate is made on the basis of the optical and spin-resonance spectra. The spectra are discussed in terms of a modified-ligand electrostatic field. The visible spectra are assigned to transitions between 3d levels of the copper ion, but ligand orbitals must be partly intermixed with these d orbitals in order to explain all the known data. This model is then extended to the more complicated case of vanadyl chelates. The optical spectra of seven vanadium (IV) complexes with β-diketones are discussed. Their relationship to the molecular structure of the chelates is established and correlated with properties of the metal ion and the ligand. Electron spin-resonance spectra of both solutions and single crystals of vanadium (IV) chelates are presented and related to the optical spectra. The methods of preparation of these compounds are described. The model developed from the discussion of vanadyl and copper chelates is extended to the chelates of all the metals of the first transition series. An explanation for the stabilities of complexes of these metals is offered in terms of this model. (auth)

6443 UCRL-8141

California. Univ., Berkeley. Radiation Lab.

CHEMISTRY DIVISION QUARTERLY REPORT [FOR] SEPTEMBER, OCTOBER, NOVEMBER 1957. Dec. 20, 1957. 82p. Contract W-7405-eng-48. $2.25(OTS).

Bio-Organic Chemistry. Experiments made on Chlorella to determine the effect of C^{14} on the rate of CO_2 utilization during photosynthesis demonstrate that, aside from the usual isotope effect, there is no effect of C^{14} at specific activity levels as high as 20%. Paper chromatographic analysis of the products of photosynthesis allowed a tentative identification of 2-carboxy, 4-keto pentitol and the

lactone of 2-carboxy, 3-keto pentitol. To aid in the tracking of H in photosynthesis, an apparatus was designed to provide continuous shaking of six vessels while they were simultaneously illuminated from the bottom. Experiments indicate that 0.001 M NH_4NO_3 added to suspensions of Chlorella in distilled water has a marked effect on increasing the total fixation of C^{14} (usually close to 100% increase), and also greatly increases the activity found in amino acids. Marked effects are also made on the sugar phosphates and sucrose, but not always in the same direction. Photosynthetic experiments to determine whether the ammonium ion or nitrate ion is responsible for the effect noted and to determine the effect of the constituent salts of the normal nutrient solution upon the uptake and distribution of C^{14} show that the addition of mineral salts to a suspension of Chlorella in distilled water may have striking effects on the uptake rate and distribution of C^{14}. The scheme for the degradation and resynthesis of morphine is outlined. Results of experiments on the utilization of adenine and 5′-adenylic acid by C_{57} mice are tabulated. Studies on the incorporation of adenine-C^{14} into nucleotides and nucleic acids in rats indicate that the distribution and utilization of adenine and its interconversion to guanine are markedly affected by the dosage level of adenine. The general behavior of phosphorylated glycolytic intermediates following glucose introduction is outlined. In experiments on the genetic influence on the enzyme levels in the brain of the rat, the fifth generation is being analyzed. The difference between the average value for ChE (average value for the visual and somesthetic areas) was 12.5 for the Roderick D Hi line–Roderick D Lo line and 7.0 for the Roderick C Hi line–Roderick C Lo line. The action spectrum of Chlorella luminescence follows its absorption spectrum very closely. The action spectrum of Nostoc luminescence is significantly different from its absorption. Both the action spectrum and the room temperature emission spectrum of whole spinach chloroplasts are very similar to those for Chlorella. A study is being made of the photo- and semiconductivity of organic compounds that have conjugated ring systems. Choline chloride was synthesized deuterated in the α and β positions and completely deuterated in the methyl position. These compounds were irradiated and the electron spin spectra determined. Nuclear Chemistry. The crystal structure of ruthenocene (dicyclopentadienyl ruthenium) $Ru(C_5H_5)_2$ was determined by the x-ray crystallographic method. Spallation reactions for He^4 ions incident on U^{238} which yield U^{237}, U^{239}, Np^{238}, and Pu^{238} were studied at bombarding energies of 20 to 48 Mev. Np, obtained from U^{238} bombarded with helium ion, was chemically separated and then mass separated. The Np^{241} mass-separated plate yielded a single decay period of about 3.5 hours. Chemical Engineering. Zone melting has been tried on 50-50 mixtures of naphthol and naphthalene with zone travel rates of approximately ½ to ¾ in. per hour and stirrer speeds of 0 to 270 rpm. Basic Chemistry. The rate law for the formation of hypoiodite ion from iodide and hypochlorite ions in 1 M sodium hydroxide solution is $d(IO^-)/dt = k(L^-)\,(OCl^-)/(\overline{O}H^-)$. Preliminary measurements on the heat capacity of powdered MgO show that the heat capacity increases more slowly than T^3 in the range 1.2 to 4.2°K. (For preceding period see UCRL-3950.) (J.S.R.)

6444 USNRDL-TR-197

Naval Radiological Defense Lab., San Francisco.

APPLICATION OF GAS CHROMATOGRAPHY TO PROBLEMS IN RAPID DEGRADATIVE REACTIONS OF SOLIDS. S. B. Martin. Oct. 7, 1957. 43p. (AFSWP-1051).

Gas chromatographic methods are described for determining the products evolved by organic solids (or liquid with small vapor pressure) when rapidly decomposed directly in the carrier gas stream by suitable external stimuli. The method, presently employed to study the chemical reactions accompanying the ignition of cellulosic solids by intense radiant energy, utilizes special dynamic cold traps to separate the complex products into fractions which can be conveniently analyzed by the various gas-solid absorption and gas-liquid partition columns. A simple technique is also presented for the ultimate analysis of the remaining solid residue involving chromatographic analysis of the products of its complete combustion. (auth)

6445 WAPD-CTA(GLA)-310(Rev. 1)

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

PREPARATION OF SILVER CHLORIDE. Anne Simpson. May 3, 1957. 3p. $1.80(ph OTS); $1.80(mf OTS).

When a solution of ammonium chloride (NH_4Cl) is added to a solution of silver nitrate ($AgNO_3$), silver chloride is precipitated. By carefully controlling the concentrations of the solutions and the subsequent recovery of the precipitate, high purity silver chloride is obtained as a crystalline powder suitable for spectrographic purposes. (auth)

6446 AEC-tr-2413

NOTE ON THE REACTIVITY OF WATER VAPOR AND HYDROGEN PEROXIDE WITH LIGHT METALS AT HIGHER TEMPERATURES. Oswald Kubaschewski and Hans Ebert. Translated from Z. Metallkunde 38, 232-5(1947). 7p.

When water vapor is conducted over Mg, a weak oxidation occurs at temperatures starting at 400°; at approximately 640° an accelerated transformation starts, which is practically dependent on the flow rate of the incoming water vapor only. Aluminum reacts at approximately 700° much more slowly and without a noticeable temperature increase. The diffusion velocity of the Al through the oxide layer may be the rate determining factor here. The reason for the different behavior are the different volume ratios V_{oxide}/V_{metal}. Magnesium–aluminum alloys behave in such a manner as if the two metals were not alloyed at all. Oxygen and H_2O_2 react with Mg at an accelerated rate only at temperatures of 640°, as water vapor reacts. The reduction of the peroxide reacts completely under the formation of Mg and H_2. (auth)

6447 NP-tr-50

THE PREPARATION OF STRONTIUM-90 FREE YTTRIUM-90 BY ELECTROLYSIS. Gerald Lange, Guenter Herrmann, and Fritz Strassmann. Translated by M. Moore from J. Inorg. and Nuclear Chem. 4, 146-54(1957). 7p.

6448 NP-tr-52

THE REDUCTION OF COMBINED CARBON DIOXIDE IN SOLIDS TO CARBON AND THE ELECTROCHEMICAL CHANGES IN SOLID SUBSTANCES. F. Haber and St. Tolloczko. Translated by F. Hudswell from Z. anorg. Chem. 41, 412-20; 440-1(1904). 7p.

6449 NP-tr-58

MAGNESIUM HYDRIDE MgH_2. Egon Wiberg and Richard Bauer. Translated from Ber. deut. chem. Ges. 85, 593-605(1952). 16p.

Ohio State Univ. Research Foundation Translation No. 39.

The preparation of magnesium hydride by pyrolysis of magnesium dialkyls and of Grignard compounds was investigated. The hydride can be prepared pure in high vacuum at 200° by the thermal decomposition of diethyl magnesium, but, in the pyrolysis of dibutyl magnesium, a magnesium hydride is formed contaminated with magnesium. With dephenyl magnesium, a complete degradation of the compound occurs with no formation of the hydride. With the Grignard compounds magnesium hydride is formed in the pyrolysis of ethyl and butyl magnesium halide, but the pyrolysis of phenyl magnesium halide leads to degradation

of the compounds. The hydride is a white, solid, nonvolatile, ether-insoluble, water-sensitive, and easily oxidizable substance which decomposes in high vacuum only above 280° into its elements. It forms with boron and aluminum hydride double hydrides of the form $MgH_2 \cdot 2XH_3$. (J.S.R.)

6450

RADIATION IN THE PETROLEUM INDUSTRY. T. J. Hardwick and R. P. Nejak (Gulf Research & Development Co., Pittsburgh). Chem. Eng. Progr. 54, No. 2, 72-3 (1958) Feb.

The use of ionizing radiation for inducing chemical changes in petroleum products is described. (W.L.H.)

6451

BORON HYDRIDES. Coleman J. Major (American Potash & Chemical Corp., Henderson, Nev.). Chem. Eng. Progr. 54, No. 3, 49-54(1958) Mar.

Boron hydrides are now coming into importance under the impetus of high calory jet fuel requirements. Diborane may be used as the starting material for the preparation of nearly all the other boron hydrides. Therefore greatest attention is focused on the preparation of diborane itself. Methods of preparation are described. (A.C.)

6452

INVESTIGATION OF ISOTOPIC EXCHANGE OF OXYGEN BETWEEN HEAVY OXYGEN WATER AND SOME NIOBATES AND TANTALATES. V. I. Spitsyn, A. V. Lapitskii, R. I. Aistova, D. Nishanov, and V. A. Pchelkin (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 118, 107-9(1958) Jan. 1. (In Russian)

Experiments were made with saturated solutions of sodium pentatantalate ($6.88\ Na_2O \cdot 5Ta_2O_5 \cdot 29.1\ H_2O$), sodium hexatantalate ($3.92\ Na_2O \cdot 3Ta_2O_5 \cdot 26.1\ H_2O$), potassium hexaniobate ($7.04\ K_2O \cdot 6Nb_2O_5 \cdot 22.0\ H_2O$), potassium methaniobate ($0.96\ K_2O \cdot Nb_2O_5 \cdot 4.36\ H_2O$), and heavy oxygen water (with 1.28 at. % O^{18}), investigated for 5 hr at 95° temperature. Due to hydrolysis the salt solutions had an alkaline reaction (pH = 11 to 12). Results of the isotopic exchange of oxygen between the water and sodium tantalates and potassium niobates and calculations of the O^{18} content in the solvent after the exchange are tabulated. (R.V.J.)

6453

CRITICALITY AND ITS EFFECT ON THE STUDY AND THE USE OF CHEMICAL INSTALLATIONS TREATING FISSILE MATERIALS. A. H. Gillieson (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Énergie nucléaire 1, 17-19(1957) Jan.-Mar. (In French)

A summary is given of the theoretical and practical factors for safe operations in the transport, storage, and treatment of fissile materials. (tr-auth)

6454

PREPARATION OF PURE ANHYDROUS ZIRCONIUM FLUORIDE. C. Decroly (l'Université libre de Brussells) and D. Tytgat and J. Gérard (Centre d'Etudes pour les Applications de l'Energie Nucléaire, Belgium). Énergie nucléaire 1, 155-60(1957) July-Sept. (In French)

The preparation of pure and anhydrous (with hafnium) zirconium fluoride was studied on a laboratory scale. The starting material was zirconium oxide. Ammonium acid fluoride was used as the fluorinating agent. Ammonium fluozirconate was transformed to zirconium fluoride by heating in a vacuum. The zirconium fluoride was purified by sublimation at 700° in a vacuum. The material used in this last operation was particularly described. The efficiency of conversion from the oxide to the sublimed fluoride is 95%. (tr-auth)

6455

THE REACTION OF NITRIC ACID ON FORMALDEHYDE. J. B. Morris (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Énergie nucléaire 1, 216-24(1957) Oct.-Dec. (In French)

In the chemical treatment of fuels from high energy atomic piles it is advantageous to eliminate nitric acid from aqueous solutions without the addition of an electrolyte. Treatment by formaldehyde is a possible method because the theoretical products are gas and water. Tests have shown that nitric acid can be treated by formaldehyde in a simple manner without danger, either continuously or discontinuously. Formaldehyde reacts very rapidly in acid more concentrated than 1.4 M, but much slower in weaker concentrations. One of the advantages of continuous treatment is that more than twice the quantity of nitric can be eliminated with the same quantity of formaldehyde. Some empirical kinetic equations were established to interpret the test results. The problem of safety is discussed. (tr-auth)

6456

MAGNETIC NUCLEAR RESONANCE IN CHEMISTRY. H. Labhart (CIBA and Universität Basel). Experientia 14, 41-54(1958).

This paper gives a simple outline of those features of the theory of nuclear magnetic resonance that are important to chemical applications. After a short description of apparatus and experimental techniques, there follows a number of representative chemical applications. The possibilities of the method are compared with the information obtained from infrared spectroscopy. (auth)

6457

LIQUID TIN SOLUTION CALORIMETER FOR MEASURING HEATS OF FORMATION OF ALLOYS. Raymond L. Orr and Ralph Hultgren (Univ. of California, Berkeley) and Alfred Goldberg (U. S. Naval Postgraduate School, Monterey, Calif.). Rev. Sci. Instr. 28, 767-73(1957) Oct.

A liquid tin solution calorimeter has been constructed for determining the heats of formation of alloy phases from the heats of solution of the alloys and of the pure component metals in liquid tin. The design of the calorimeter is presented, and the experimental procedures and calculation methods are described and illustrated with data from representative runs. These indicate that heats of formation of alloy phases may be determined with an average uncertainty of about ± 50 cal/g atom. (auth)

6458

EFFECT OF CRYSTALLOGRAPHIC ORIENTATION AND OXYGEN CONTENT ON KNOOP HARDNESS VALUES OF IODIDE TITANIUM. C. Feng and C. Elbaum (Univ. of Toronto, Can.). Trans. Met. Soc. AIME 212, No. 1, 47-50 (1958) Feb.

Knoop hardness measurements were carried out on large grains of iodide titanium containing different amounts of oxygen. For each oxygen content the hardness is recorded as a function of the crystal orientation and of the angle ϕ between the indenter diagonal and the projection of the C (hexad) axis in the surface. The results can be expressed by the following relation: hardness = $n - k \cos 2\phi$, where n and k are constants for a given oxygen content and crystal surface orientation. (auth)

Analytical Procedures

6459 AECU-3505

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

DETECTION OF AIR-BORNE BERYLLIUM DUST. Final

Report Covering the Period from May 1955 to February 1957. R. Gold and C. A. Stone. Apr. 25, 1957. 85p. Project No. A-057. Contract AT(11-1)-346.

Present chemical techniques for analyzing minute amounts of beryllium are involved and quite time consuming. A method has been developed, utilizing the yield of neutrons and gamma rays from Be^9 under alpha particle bombardment. Samples of air-borne beryllium dust collected on filter paper are exposed to Po^{210} alpha particles and can be analyzed in a matter of minutes. A 3 × 3 inch NaI(Tl) crystal and low voltage discriminator are used to detect the gamma ray yield (4.45 Mev). This yield has been correlated with the beryllium content of filter paper down to ~ 0.2 μg. This technique should greatly facilitate the evaluation of industrial beryllium dust hazards. (auth)

6460 AERE-C/R-453(Del.)
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE ESTIMATION OF NITRIC ACID IN THE PRESENCE OF URANYL NITRATE AND AMMONIUM NITRATE. "THE OXALATE METHOD." L. Airey, E. Furby, and J. A. Woodward. Feb. 1950. Decl. with deletions Jan. 6, 1958. 19p.

A procedure for directly titrating free HNO_3 after complexing the uranyl ion with potassium oxalate is described. It was found that the accuracy of the method is affected by changes in the uranium concentration and to a lesser extent by the presence of ammonium nitrate. (W.L.H.)

6461 AERE-C/R-2116
United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.
THE SEMI-QUANTITATIVE DETERMINATION OF TRACES OF SODIUM, POTASSIUM AND MAGNESIUM IN BISMUTH AND BISMUTH–URANIUM ALLOYS. R. J. Webb. Dec. 1957. 9p. $0.32(BIS).

The bismuth or bismuth–uranium alloy is converted to oxide and excited in the D.C. Arc under standardized conditions. A Medium Quartz Spectrograph is used for recording the spectra which are evaluated by visual comparison with spectra of synthesized samples containing known concentrations of sodium, potassium and magnesium. The method is suitable for the determination of sodium, potassium and magnesium down to concentrations of 1 to 2 ppm. (auth)

6462 CEA-676
France. Commissariat à l'Énergie Atomique, Paris.
DÉTERMINATION SPECTROGRAPHIQUE DU LITHIUM DANS LE CALCIUM NUCLEAIRE. (Spectrographic Determination of Lithium in Nuclear Grade Calcium). J. Artaud and J. Cittanova. Apr. 1957. 8p.

A method is described for the spectrographic determination of lithium in calcium. The samples are converted directly to $CaCO_3$. A method of fractional distillation in the arc, using KCL as carrier, makes it possible to detect and measure the Li content to 0.1 ppm. (auth)

6463 LA-1350
Los Alamos Scientific Lab., N. Mex.
THE DETERMINATION OF OXYGEN IN PLUTONIUM BY THE CAPILLARY TRAP METHOD. William G. Smiley. Feb. 2, 1953. Decl. Mar. 6, 1958. 35p. Contract W-7405-eng-36. $6.30(ph OTS); $3.00(mf OTS).

A new method for the determination of O_2 in metals is described. The sample is dropped into molten Pt in a graphite crucible. The oxide in the sample reacts with C to form CO, which is swept out by a stream of Ar at atmospheric pressure. The CO is oxidized to CO_2, which is condensed in a capillary trap and measured with a capillary manometer. The apparatus is sensitive to 0.3 μg of O_2, and routine 50-mg Pu samples give a standard deviation of 7 ppm or 0.35 μg. Pu samples with added O_2 gave a standard deviation of 1.5 μg or 2% of the total oxygen, with no significant bias. The apparatus is simple and rugged, permitting replacement of parts without glassblowing. The speed is superior to vacuum fusion methods, most samples requiring only twelve minutes for analysis. (auth)

6464 WAL-TR-401/289
Watertown Arsenal Lab., Mass.
BISMUTHATE METHOD FOR THE DETERMINATION OF MANGANESE IN TITANIUM. F. P. Valente. Jan. 1958. 11p. DA Project 5B93-32-002.

The object of this study was to determine the feasibility of analyzing titanium-base alloys for manganese by a bismuthate method. A procedure is presented based on a bismuthate oxidation of manganous ions to permanganate ions followed by reduction with excess ferrous ammonium sulfate and back-titration with standardized potassium permanganate. The method has been tested successfully on synthetic manganese-titanium solutions and on several manganese alloys. The reagent, sodium bismuthate, appears to affect the results. (auth)

6465 WAPD-CTA(GLA)-162-1(Rev. 2)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE SPECTROCHEMICAL DETERMINATION OF IMPURITIES IN ZIRCONIUM AND ZIRCALOY USING THE SILVER CHLORIDE CARRIER TECHNIQUE. R. F. Farrell, R. M. Jacobs, and N. E. Gordon. May 3, 1957. 7p. $1.80(ph OTS); $1.80(mf OTS).

6466 WAPD-CTA(GLA)-162-3(Rev. 2)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE SPECTROCHEMICAL DETERMINATION OF BORON AND CADMIUM IN ZIRCONIUM AND ZIRCALOY USING THE SILVER CHLORIDE CARRIER TECHNIQUE. R. M. Jacobs, R. F. Farrell, and N. E. Gordon. May 2, 1957. 4p. $1.80(ph OTS); $1.80(mf OTS).

6467 WAPD-CTA(GLA)-162-5(Rev. 2)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE SPECTROCHEMICAL DETERMINATION OF ALUMINUM AND COPPER IN ZIRCALOY-2 AND ZIRCALOY-3 USING D.C. ARC EXCITATION AND A BARIUM FLUORIDE FLUX. R. M. Jacobs, R. F. Farrell, and T. F. Anater. May 6, 1957. 4p. $1.80(ph OTS); $1.80(mf OTS).

6468 WAPD-CTA(GLA)-162-6(Rev. 2)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE SPECTROCHEMICAL DETERMINATION OF RESIDUAL ALUMINUM IN ZIRCONIUM USING ALTERNATING CURRENT SPARK EXCITATION. R. M. Jacobs, R. F. Farrell, and J. F. Frain. May 2, 1957. 4p. $1.80(ph OTS); $1.80(mf OTS).

6469 WAPD-CTA(GLA)-315(Rev. 1)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE PREPARATION OF SPECTROGRAPHIC STANDARDS FOR THE ANALYSIS OF IMPURITIES IN ZIRCONIUM AND ZIRCALOY. G. J. Harter and R. F. Farrell. May 6, 1957. 7p. $1.80(ph OTS); $1.80(mf OTS).

6470 AEC-tr-2819
A QUANTITATIVE ANALYSIS OF LANTHANUM BY BAND-SPECTRA OF LANTHANUM OXIDE. R. Tshida. Translated from J. Chem. Soc. Japan, Pure Chem. Sect. 76, 60-3(1955). 8p.

Band spectra of monoxides of rare earth elements have been photographed by using flame as a light source. It is well known that the temperature of the light source is about 2000 to 3000°K and the structure of the electron shells is just suitable for analyzing the band spectra of diatomic

molecules resembling the alkali elements. According to the above report, rare earth elements such as scandium, yttrium, lanthanum, gadolinium, samarium and europium will give band spectra of the monoxides in a flame of the air-acetylene system. Since lanthanum does not give any characteristic absorption spectra by this method, it is considered to be useful for its detection and quantitative analysis. In the present experiment, the lanthanum oxide solution is atomized and introduced into the flame of an air-acetylene system and thus prepared for spectral analysis. (auth)

6471 AEC-tr-3162

DETERMINATION OF HYDROGEN IN CERTAIN METALS BY THE METHOD OF ISOTOPIC BALANCING. A. N. Zaidel. Translated from Zhur. Tekh. Fiz. 25, 2571-3 (1955). 7p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 10, as abstract No. 4535.

6472 NP-tr-13

MICROPOLAROGRAPHIC INVESTIGATIONS. I. APPARATUS AND TECHNIQUES. Vladimir Majer. Translated from Mikrochemie 18, 74-88(1935). 12p.

6473 IGRL-T/R-68

THE DETERMINATION OF THE NOBLE METAL CONTENT OF RHINE WATER. F. Haber and J. Jaenicke. Translated by G. P. Cook from Z. anorg. u. allgem. Chem. 147, 156-70(1925). 10p.

6474 IGRL-T/W-69

THE QUANTITATIVE DETERMINATION OF POTASSIUM WITH SODIUM TETRAPHENYL BORATE. W. Lieber. Translated by G. P. Cook from Zement-Kalk-Gips 10, 61-2(1957). 5p.

6475

THE DETERMINATION OF MICROGRAM AND SUB-MICROGRAM AMOUNTS OF BORON. PART I. ABSORPTIOMETRIC DETERMINATION USING CURCUMIN. G. S. Spicer and J. D. H. Strickland (U. K. Atomic Energy Authority, Research Group, Woolwich Outstation, Royal Arsenal, London). Anal. Chim. Acta 18, 231-9(1958) Mar.

Three methods are described for the absorptiometric determination of boron present in alkaline residues in a platinum dish. These are based on the reaction of boric acid and a curcumin reagent to form the red compounds rubrocurcumin and rosocyanin. The first method is suitable for quantities of the element between about 2 and 15 μg, the second is best used when between 0.5 and 4 μg are present and the third when the highest sensitivity is required, 0.01 to 0.2 μg. The last method does not involve the use of an oxalic acid promotor and is thought to give the maximum sensitivity possible for any absorptiometric technique. The three procedures were developed and have been used over the last decade for the analysis of atomic energy materials and have received very thorough testing under routine conditions. (auth)

6476

COULOMETRIC TITRATION OF URANIUM AND URANIUM-VANADIUM MIXTURES WITH +3 TITANIUM. John H. Kennedy and James J. Lingane (Harvard Univ., Cambridge, Mass.). Anal. Chim. Acta 18, 240-4(1958) Mar.

Coulometric titration of +6 uranium with electrogenerated titanous ion at a platinum cathode in 8 F sulfuric acid can be performed accurately in the presence of ferrous ion as a catalyst. Amperometric end-point detection is employed. The titration is suitable for the precise assay of uranium compounds. Mixtures of +5 vanadium and +6 uranium can be titrated, because the reduction of +5 vanadium occurs at a more oxidizing potential than the reduction of +4 vanadium and +6 uranium. Using amperometric end-point detection, two end-points are observed corresponding to the reduction of +5 vanadium to the +4 state, and to the simultaneous reduction of +4 vanadium to the +3 state and +6 uranium to the +4 state. Errors are as small as ±0.3%, provided the uranium/vanadium ratio is between 0.1 and 10. (auth)

6477

DETECTION OF UNCOMBINED OXYGEN IN ZIRCONIUM METAL. Louis Silverman and Wanda Bradshaw (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Anal. Chim. Acta 18, 253-8(1958) Mar.

This study was undertaken to develop a means of determining oxygen in zirconium which is present in a form other than that of zirconium oxide. The method described determines oxygen which is evolved as molecular oxygen when solid zirconium metal is dissolved in hydrofluoric acid solution. The oxygen evolved is caught in a separate flask and ultimately determined colorimetrically as iodine. In this procedure, the oxygen held as ZrO_2 is not evolved and is not determined. The range of oxygen determined by this method was between 50 to 170 μg which is equivalent to 0.06 to 0.22% oxygen. The deviation was ±0.01% oxygen. (auth)

6478

RADIOCHEMICAL ANALYSIS FOR LONG-LIVED FISSION PRODUCTS IN ENVIRONMENTAL MATERIALS. W. F. Merritt (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Can. J. Chem. 36, 425-8(1958) Mar.

A method is described whereby radiochemical analysis for the long-lived fission products Ru^{106}, Sr^{90}, Cs^{137}, and Ce^{144} may be performed on the same sample of soil, water, or biological material. Carriers are added and the material is fused at 550°C with KOH, KNO_3, and K_2CO_3. Ruthenium and cesium are extracted with water, strontium and cerium remaining in the melt. Ruthenium is extracted into carbon tetrachloride as ruthenium tetroxide, cesium is absorbed on Duolite C-3 cation-exchange resin from alkaline solution, strontium and cerium are extracted from the melt with acid, cerium is precipitated as the hydroxide and strontium as the carbonate. The elements are precipitated, weighed, and counted according to standard procedures. (auth)

6479

DETERMINATION OF Sr^{90} IN WATERS SATURATED WITH CALCIUM. P. Cohen, G. Pardo, and G. Wormser (Centre d'Études Nucléaires, Saclay, France). Énergie nucléaire 1, 89-90(1957) Apr.-June. (In French)

The method of Straub for the determination of radiostrontium in water saturated with calcium is valid within very large limits and in particular in the case of residual waters from the chemical purification of radioactive liquid effluents of the C.E.N. of Saclay. The separation of strontium and calcium is done by an acetone anhydride extraction of the nitrates. The Sr^{90} is then counted in the oxalate form. (J.S.R.)

6480

ALPHA-RAY ACTIVITIES OF HUMANS AND THEIR ENVIRONMENT. R. C. Turner, J. M. Radley, and W. V. Mayneord (Royal Cancer Hospital, London). Nature 181, 518-21(1958) Feb. 22.

Results are presented from the analysis of samples of human and animal tissue, soils, foodstuffs, and fertilizers for natural and artificially-induced α activity. It is concluded that food is the important factor in determining the daily intake of naturally occurring radioactive material by animals, and its intake completely overshadows the intake from milk and water. (C.H.)

6481

QUALITATIVE METHODS OF ROENTGENSPECTRAL

ANALYSIS. E. E. Vainshtein. Publishing House of Academy of Sciences, U.S.S.R. Moscow, 1956. 229p. (In Russian)

The problems of quantitative x-ray analysis by photographing-recording of spectra are discussed. Peculiarities in the aspects of x-ray emission interaction with the photoemulsion are analyzed. Systematic descriptions are given of the x-ray spectroscopy with photographic recording of the spectral intensities. Illustrations are presented of the experiments and cases of successful applications of the described method. (R.V.J.)

Crystallography and Crystal Structure

6482

COMPARISON OF THE STRUCTURE OF THE OMEGA TRANSITION PHASE IN THREE TITANIUM ALLOYS. S. A. Spachner (Illinois Inst. of Tech., Chicago). Trans. Met. Soc. AIME 212, No. 1, 57-9(1958) Feb.

An analysis of the powder patterns of the omega transition phase in three binary titanium alloys containing 8% Cr, 13% Mo, and 15% V, respectively, showed that all could be indexed on an orthorhombic unit cell. The unit-cell dimensions were all quite similar. There is evidence for the occurrence of more than one transition phase in Ti–Cr and Ti–V alloys. (auth)

Deuterium and Deuterium Compounds

6483 NEI-77(Rev. 1)

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

TABLES OF PROPERTIES OF HEAVY WATER (D_2O) AT SATURATION TEMPERATURES. J. Howieson, comp. Aug. 1957. 8p.

6484

PRODUCTION OF HEAVY WATER. Sojka Jaroslav. Chem. Prumysl. 6, No. 4, 170-2(1956). (Translated from Referat. Zhur. Khim. No. 4, 1957, Abstract No. 12321).

A comparison is presented of the physicochemical constants of H_2O and D_2O and a review of the procedures and schemes of preparation of D_2O: (a) by distillation of water; (b) by the exchange reaction: $H_2O + HD \rightleftharpoons HDO + H_2$; $HDO + D_2 \rightleftharpoons D_2O + HD$ in the presence of Pt or CrNi catalyst, in the course of which the deuterium is concentrated in the water from which it is then recovered electrolytically; (c) by distillation of hydrogen.

Fluorine and Fluorine Compounds

6485

POTENTIAL FUNCTION AND NORMAL COORDINATES OF FLUOROFORM. J. Fernandez Biarge, J. Herranz, and J. Morcillo (Instituto de Quimica Fisica «Rocasolano». Serrano, 119, Madrid). Anales real soc. españ. fís. y quím. (Madrid) Ser. A. 50, 235-48(1957) Nov.-Dec. (In Spanish)

Practically all normal coordinate treatments of methane derivatives carried out up to now have assumed tetrahedral angles around the central carbon atom. Electron diffraction and spectroscopic investigations have shown that, in some cases, deviations from the tetrahedral figure may be appreciable. In the present paper a treatment of the normal vibrations for CX_3Y type molecules, without the assumption of tetrahedral angles, is presented. The Wilson FG matrix method was used in the calculations. The Raman and infrared spectral data in the literature for CF_3H gaseous have been critically examined in comparison with our present results and with the infrared data for CF_3D, and a decision was made as to the probable values of the fundamental frequencies of CF_3H. By means of a method of successive approximations force constants for the fluoroform molecule were calculated, using a potential energy function containing all possible second degree terms. In both molecules, CF_3H and CF_3D, it was found possible to reproduce the experimental frequencies to within less than their experimental error. Finally, the normal coordinates for the CF_3H molecule have been calculated. (auth)

6486

ORIGIN OF NUCLEAR MAGNETIC RESONANCE SHIFTS IN PARAMAGNETIC MnF_3. R. G. Shulman and V. Jaccarino (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. 109, 1084-5(1958) Feb. 15.

The nuclear magnetic resonance of F^{19} in MnF_3 has been observed and shifts from the normal resonance field of several percent have been measured. The shifts are paramagnetic, and it is shown that the mechanism of electron transfer cannot account for a shift in this direction. However, the results could be explained by covalent bonding between fluorine and manganese. (auth)

Graphite

6487 AECD-4260

[Los Alamos Scientific Lab., N. Mex.]

PRELIMINARY INVESTIGATIONS INTO THE PREPARATION OF EXTRUDED GRAPHITE. William B. Gibson. [1957?]. Decl. Mar. 13, 1958. 24p. Contract [W-7405-eng-36]. $4.80(ph OTS); $2.70(mf OTS).

Graphite was prepared by means of hydraulic extrusion, with densities as high as 1.90 gm/cc, in rods of up to 3/4-in. in diam. Densities higher than 1.90 gm/cc can be obtained by impregnating the graphite. It may be possible, by properly controlling the particle size distribution in the feed material, to achieve higher densities without impregnation. Variables studied included die temperature, mixing technique, binder material, baking procedures, some lubricants and additives, and preliminary work on the investigation of the effect of particle size. (auth)

6488 AERE-C/R-2219

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE ADSORPTION OF WATER ON PILE GRAPHITE. C. C. Horton and L. E. J. Roberts. 1958. Date of MS. July 1950. Decl. with amendment Mar. 1957. 25p. $0.72(BIS).

Declassified version of AERE-C/R-558.

The equilibrium amount of water present on small specimens of pile graphite at 22 to 25°C was determined as a function of the relative humidity of the ambient atmosphere. The amounts adsorbed were of the order 1×10^{-4} w/w at 80% relative humidity and 5×10^{-4} w/w at 95% relative humidity. The rate of adsorption of water vapor from a wet air stream on pile graphite was determined for various relative humidities and specimen sizes at 25°C, and for one specimen size at 50°C. The results admit of extrapolation to the size of block found in a pile. A pile block would reach half saturation value in about 27 hr and 80% of the saturation value in about 11 days, if the relative humidity of the air stream was less than 85%. The change in the pile reproduction factor 'K' arising from the changes in the amount of water adsorbed on the graphite may be estimated from the results for various pile operating conditions. (auth)

6489 NAA-SR-Memo-1874
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
GRAPHITE OUTGASSING. R. Carter, H. Taketani, and D. Wilcox. Mar. 15, 1957. 26p. $4.80(ph OTS); $2.70 (mf OTS).

Empirical test procedures called for the evacuation of the system containing the graphite to a vacuum of approximately 1 μ for 8 hr to remove all the gases that could be removed by exposing the graphite to a vacuum. Due to the large number of runs that had to be made, an 8-hr pump-down time was impractical. Hence, the system was pumped to 4 μ using a 20 min pump-down time, the valve leading to the vacuum pump was shut off, and the pressure rise in the system was observed. At room temperature the background pressure rise as a function of time is illustrated. This pressure rise was subtracted from the total pressure rise resulting from the heating of the graphite for a given time. (auth)

6490
EFFECT OF CARBON DIOXIDE CONCENTRATION OF GASIFICATION OF ARTIFICIAL GRAPHITE. P. V. N. Ramachandra Rao and E. E. Peterson (Univ. of California, Berkeley). Ind. Eng. Chem. 50, 331-6(1958) Mar.

The kinetics of the carbon–carbon dioxide reaction were determined at 1100°C. The partial pressure of carbon dioxide in the bulk gas stream was varied, and changes in over-all reaction rate and differential reaction rates at various depths within the pore system of graphite rods were measured. (W.L.H.)

6491
GRAPHITE AS A HIGH TEMPERATURE MATERIAL. John E. Hove (Atomics International Div., North American Aviation Inc., Canoga Park, Calif.). Trans. Met. Soc. AIME 212, No. 1, 7-13(1958) Feb.

The high temperature physical properties of graphite are reviewed and interpreted in the light of present day knowledge of the mechanisms affecting these properties. The thermal and mechanical behaviors only are discussed and, whenever possible, comparisons are made with other refractory materials. Possible further studies are indicated, including some carbide work. (auth)

Laboratories and Equipment

6492 CF-58-2-7
Oak Ridge National Lab., Tenn.
HYDRAULIC CYCLONES FOR THORIUM OXIDE PARTICLE SIZE CLASSIFICATION. L. L. Bennett and D. G. Thomas. Feb. 3, 1958. 23p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

Results are reported concerning studies of hydraulic cyclones (hydroclones) for application to particle size classification of ThO_2. Tests were run with a 0.50-in. diam. hydroclone. It was shown that a single pass through this hydroclone would reduce the material greater than 10 μ from 12 wt. % to less than 1% while the mean diameter was reduced from 1.7 to 0.9 μ. When the overflow (fine) fraction was again pumped through the hydroclone, the overflow solids from the second pass were 98 wt. % less than 2 μ in diameter. The mean diameter was reduced from 0.9 μ to about 0.7 μ by the second pass. A yield of 5 to 7 wt. % of solids (to the overflow stream) and a ratio of overflow to feed volume of 0.25–0.30 were observed during the hydroclone tests. Although this low yield is undesirable, recommendations are made that would increase the yield sufficiently to make desirable the incorporation of hydroclones in the ThO_2 production flow sheet. (auth)

6493 DP-239
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
EQUIPMENT FOR NUCLEAR FUEL REPROCESSING. T. J. Colven, Jr. Oct. 1957. 20p. Contract AT(07-2)-1. $0.75(OTS).

Design information and preliminary operating characteristics are given for a critically safe mixer-settler, two continuous solvent washing units, and a number of steam jet syphons that have been tested on nitric acid–tributyl phosphate systems. (auth)

6494 DP-254
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
MIXING EFFICIENCY IN MIXER-SETTLERS. THE EFFECT OF FLOW AND PADDLE VARIABLES. William J. Mottel and Thomas J. Colven, Jr. Dec. 1957. 18p. Contract AT(07-2)-1. $0.75(OTS).

The transfer of heat was used as a measure of the mixing efficiency of a one-inch shrouded paddle in a mixer-settler. The effect of paddle speed, total flow, flow ratio, and mixer configuration on the thermal mixing efficiency was determined in over 100 runs. (auth)

6495 MLM-432
Monsanto Chemical Co. Scioto Lab., Marion, Ohio.
QUARTZ FIBER BALANCE SERVICE MANUAL. P. J. Lowry. Oct. 15, 1951. Decl. Mar. 11, 1958. 40p. Contract AT-33-1-GEN-53. $6.30(ph OTS); $3.00(mf OTS).

A manual is presented for the routine maintenance and the anticipated quartz repair which will be required on the Mound Laboratory type quartz fiber balances. (W.L.H.)

6496
HARWELL'S NEW "HOT" FACILITY. Atomics and Nuclear Energy 9, 60-1(1958) Feb.

The design, equipment, procedures, and safety precautions used in this facility are described. (M.H.R.)

6497
HARWELL'S NEW HIGH-ACTIVITY HANDLING BUILDING "459." Nuclear Eng. 3, No. 24, 121-2(1958) Mar.

Harwell's new high-activity handling building was designed for the dismantling of irradiated components and loops from DIDO and PLUTO. The unit is capable of handling components with activity levels up to 10^5 C. General layout, cell construction, and maintenance of the facility are briefly described. (W.L.H.)

6498
DISMANTLING HOT TEST LOOPS. A NEW HARWELL FACILITY. Nuclear Power 3, 108-9(1958) Mar.

A new facility for dismantling hot test loops was opened at Harwell and can handle radioactive materials up to a level of 100,000 c. The construction of the cell walls, remote handling operations, and the balanced ventilation system are described. (J.S.R.)

Radiation Chemistry

6499 BNL-454
Brookhaven National Lab., Upton, N. Y.
PREDICTIONS ON THE CHEMICAL BEHAVIOR OF IODINE IN AN LMFR FUEL. O. E. Dwyer. Apr. 15, 1957. 12p.

Experiments were performed to determine the concentrations of fission product iodine in a LMFR U–Bi–Mg–Zr fuel mixture. Measurements of the I^{131} concentration were made in the gas space above the liquid metal in the surge tank and also in the flowing metal. Results indicate that the possibility of volatilizing the great bulk of the I^{131} from an LMFR fuel does not appear likely. (W.L.H.)

6500 NP-tr-61

THE SULPHO-CHLORINATION OF HEPTANE BY MEANS OF Co^{60} GAMMA RAYS. A[rmin] Henglein and H[ans] Url. Translated by R. S. Forsyth from Z. physik. Chem. (Frankfurt) 9, 285-99(1956). 11p.

Organic sulfuric acid chlorides were formed by means of the action of gamma rays on a mixture of heptane, sulfur dioxide and chlorine. As with photochemical sulfo-chlorination, the reaction proceeds by means of radical chains. The decomposition takes place by means of free radicals which are formed by Compton electrons liberated by the ionization and excitation processes during the decomposition of the heptane. Above 10^4 r/h the velocity of the reaction is independent of intensity: below about 2×10^3 r/h the reaction velocity is proportional to the root of the intensity. In addition to sulfo-chlorination, chlorination of the heptane takes place, and the relative yield of both processes depends upon the intensity of the gamma radiation and the composition of the SO_2-Cl_2 gas mixture which is passed through. The sulfo-chlorination of heptane in CCl_4 solutions can also be effected by means of gamma radiation. The G value of the reaction depends upon the intensity of the gamma radiation, the reaction time, and the composition of the gas mixture used. G values have been found which are larger than those of the radiochemical chain reactions previously studied, and hence the sulfo-chlorination reaction seems to be of particular value for the industrial use of ionizing rays. (tr-auth)

6501

RADIATION PROCESSING. Joseph J. Martin (Univ. of Michigan, Ann Arbor). Chem. Eng. Progr. 54, No. 2, 66-71(1958) Feb.

Some of the most recent work in the field of radiation chemical processing is presented. (W.L.H.)

6502

PRIMARY COBALT-60 RADIOLYSIS YIELDS IN HEAVY WATER. H. A. Mahlman and J. W. Boyle (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 80, 773-4(1958) Feb. 20.

The Co^{60} γ-ray decomposition of several heavy water solutions, 0.4 M in sulfuric acid, has been studied and the initial yields of D, OD, D_2, and D_2O_2 determined. The reactions investigated were the formation of D_2 in a degassed dilute bromide solution, the formation of D_2O_2 in air-saturated solution and the oxidation of ferrous ion in air-saturated solution. The yields for D, OD, D_2 and D_2O_2 were evaluated to be 3.99, 3.14, 0.38 and 0.81 in heavy water solution and the H, OH, H_2 and H_2O_2 yields in light water were 3.68, 2.96, 0.45 and 0.81. All yields are relative to the light water ferrous dosimeter value of 15.6 molecules oxidized for each 100 e.v. of energy absorbed. (auth)

6503

DOSE-RATE EFFECTS IN RADIATION-INDUCED CHEMICAL REACTIONS. H. C. Sutton and J. Rotblat (Medical Coll. of St. Bartholomew's Hospital, London). Nature 180, 1332-3(1957) Dec. 14.

A 15-Mev linear accelerator was used in an experiment to study the variation of yields of chemical reactions with dose rate. Two reactions were studied: the reduction of aerated solutions of ceric ammonium sulfate in sulfuric acid and the oxidation of ferrous ammonium sulfate in an identical solvent. At each dose rate the ratio of the yields of the iron and cerium reactions was determined. (W.L.H.)

6504

EFFECT OF HIGH-ENERGY RADIATION ON POLYPROPYLENE. R. M. Black and B. J. Lyons (British Insulated Callender's Cables, Ltd., London). Nature 180, 1346-7 (1957) Dec. 14.

Samples of polypropylene were irradiated in a beam of 2 Mev electrons from a Van de Graaff accelerator. An examination of the infrared adsorption spectra showed that the principal chemical change, other than cross-linking and chain fracture, was the introduction of unsaturation of the type $R.R'C = CH_2$ (vinylidene). There is some evidence for the presence of a small amount of vinyl unsaturation, $RCH = CHR'$. (W.L.H.)

6505

ON CERTAIN REACTION MECHANISMS OF HOT ATOMS. Ian Campbell (Inst. of Nuclear Research, Warsaw). Nucleonika 2, 605-15(1957). (In Polish)

Equations are given for the total recoil energy and the fraction of recoil energy available in bond excitation from single γ quantum emission. A serial emission of several γ quanta is also discussed. Procedures are offered for applying random equations in the calculation of the fraction of recoil atoms which fail to rupture the bonds in serial γ emission of a given energy. (tr-auth)

6506

RADIOCHEMICAL METHODS IN STUDIES OF NUCLEAR REACTIONS. S. Siekierski (Inst. of Nuclear Research, Warsaw). Nucleonika 2, 641-6(1957). (In Polish)

Radiochemical methods are described for the identification of products in nuclear reactions and for the determination of the fragments and particles emitted by nuclei. (tr-auth)

Radiation Effects

6507 WADC-TR-56-515

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio and Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

EFFECTS OF GAMMA RADIATION ON LINEAR POLYETHYLENE. [Period covered] September 1955-October 1956. William B. Terrell and Jack T. Humphries. Oct. 15, 1956. 45p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: MEASUREMENTS BY RADIATION. (AD-142343).

Linear polyethylenes have recently been developed which have empirical chemical formulas identical to those of common polyethylenes, but which differ in the molecular arrangement of the polymer chain. The physical properties of two linear polyethylenes were measured before and after gamma irradiation to afford a comparison with conventional polyethylene. Measurements were made of the following properties as functions of total radiation dosage up to 10^9 roentgens: tensile strength, elongation, hardness, impact strength, specific gravity, water absorption, heat distortion temperature, dielectric constant, arc resistance, color, and infrared absorption. In addition, densities were determined as functions of both radiation dosage and temperature. (auth)

6508

INACTIVATION OF THE β-GLUCOSIDASE OF ALMONDS BY X RAYS. Cécile Sosa-Bourdouil, Paul Bonet-Maury, and Antoine Sosa. Compt. rend. 246, 1608-11(1958) Mar. 10. (In French)

Emulsin, dry and in the absence of oxygen, was inactivated by exposure to γ radiation of Co^{60}. The diminution of the hydrolytic activity was measured on various β glucosides. The radioinactivation procedes exponentially. The functional dimensions of the hydrolyzing group calculated according to the impact theory are approximately the molecular weights of β glucosidase obtained by other methods. (tr-auth)

6509

EFFECTS OF IONIZING RADIATION ON THE AMINATION, DISAMINATION, AND TRANSAMINATION PROCESSES. R. D. Gal'tsova and M. N. Meisel (Inst. of Microbiology,

Acad. of Sciences, USSR). Doklady Akad. Nauk. S.S.S.R. 118, 75-7(1958) Jan. 1. (In Russian)

6510
EFFECTS OF RADIATION ON PLASTIC PACKAGING FILMS. H. G. LeClair and W. C. Cobbs, Jr. (E. I. du Pont de Nemours & Co., Inc., Buffalo, N. Y.). Ind. Eng. Chem. 50, 323-6(1958) Mar.

The effects of high-energy irradiation on a number of commercially available plastic films are summarized. (W.L.H.)

6511
RADIATION EFFECTS IN QUARTZ—A BIBLIOGRAPHY. R. Bechmann (U.S. Army Signal Engineering Labs., Fort Monmouth, N. J.). Nucleonics 16, No. 3, 122-38(1958) Mar.

A bibliography was compiled on the radiation effects on the color, thermal and electrical conductivity, index of refraction, and the elastic properties of quartz crystals. (J.S.R.)

Rare Earths and Rare-earth Compounds

6512
CHEMICAL TECHNIQUES USED IN CONNECTION WITH β-SPECTROSCOPIC WORK ON RARE EARTH ELEMENTS. P. Gregers Hansen and R. K. Sheline (Univ. of Copenhagen). Nuclear Instr. 2, 39-43(1958) Jan.

Cyclotron target preparation, chemical separation by ion exchange chromatography, and source preparation are described. (auth)

6513
ON RESOLUTION OF SOME ANALYTICAL PROBLEMS PERTAINING TO RARE EARTHS BY MEANS OF RADIOACTIVATION ANALYSIS. G. I. Born, K. F. Vayss, and M. G. Kobaladze (Commission on Analytical Chemistry of the Academy of Sciences, USSR). Trans. Comm. Anal. Khim. Akad. Nauk S.S.S.R. 7, No. 10, 104-18(1956). (Translated from Referat. Zhur. Khim. No. 4, 1957, Abstract No. 12059).

The possibility is considered of determining some rare earth elements by radioactivation analysis, and it is shown that by simple auxiliary means it is possible to carry out their determination with sufficient accuracy in a number of mixtures. To measure the activity of the irradiated preparations, use was made of beryllium–radium (500 mg Ra) a source of neutrons and a unit of B type with an aluminum B-1 counter tube. The procedure is described of determining Eu in samarium, Dy in yttrium earths free from Gd, and in those containing Gd, of determining Sm in cerium earths free from Eu, and determination of Gd in yttrium earths low in Eu.

6514
CONCERNING THE POTENTIOMETRIC DETERMINATION OF LANTHANUM, CERIUM, PRASEODYMIUM, NEODYMIUM, AND SAMARIUM. L. Ya. Polyak and F. M. Shemyakin (Commission on Analytical Chemistry of the Academy of Sciences, USSR). Trans. Comm. Anal. Khim. Akad. Nauk S.S.S.R. 7, No. 10, 276-88(1956). (Translated from Referat. Zhur. Khim. No. 4, 1957, Abstract No. 12061).

On studying the reactions of precipitation of Ce and La with $K_4Fe(CN)_6$ and $Na_2C_2O_4$ it is shown that they are hydrolytic precipitation reactions and there on potentiometric titration any kind of H electrode can be used (quinhydrone, antimony, glass). The possibility is shown of a potentiometric determination of Ce, La, Nd, Pr, and Sm by titration with NaOH solution. The effect of elements of the analytic group III and of Mg on potentiometric titration of Ce is described.

6515
ON THE EFFECT OF IRON ON COLORIMETRIC DETERMINATION OF CERIUM. R. K. Korabel'nik. Zhur. Anal. Khim. 11, No. 4, 419-22(1956). (Translated from Referat. Zhur. Khim. No. 4, 1957, Abstract No. 12063).

For a colorimetric determination of Ce^{4+} ferroin was utilized which, on oxidative action of Ce^{4+} with Fe^{3+}, yields an azure-colored complex. Into a 100 ml flask is poured, from a burette, a definite volume of $Ce(SO_4)_2$ solution, an excess of 0.0025 M ferroin (10 drops) is added, the solution is brought up to 100 ml and subjected to colorimetry, in a photometer of photocolorimeter, using a yellow light filter. Determination of Ce^{4+} is interfered with by all oxidizing agents having a normal potential above + 1.14v (MnO_4^-, $Cr_2O_7^{2-}$). Fe^{3+}, although its potential is + 0.77v, still vitiates the results of the determination. The distortion, in the opinion of the author, is due to formation of Ce^{4+} and Fe^{3+} complexes, at a ratio of 3:1, the existence of which was confirmed by microcrystalloscopic and spectrophotometric experiments.

Separation Procedures

Refer also to abstracts 6971, 6972, 6973, 6974, 6976, 6978, 6979, 6981, 6982, 6984, 6985, 6988, 6989, 6990, 6991, 6994, 6995, 6996, 6999, 7000, 7001, 7002, 7003, and 7005.

6516 AERE-C/R-2413
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE CHEMISTRY OF RUTHENIUM WITH REFERENCE TO THE PLUTONIUM SEPARATION PROCESS. PART IV. THE SULPHIDE TREATMENT FOR RUTHENIUM IN THE URANIUM STREAM. G. L. Miles and F. S. Martin. 1958. Date of MS. Nov. 1950. Decl. Apr. 1957. 18p. $0.54 (BIS).

The effects of the different variables in the copper coprecipitation method for removing ruthenium from plant solutions are presented in graphical form and are discussed. Liter scale experiments with the copper sulfide method and also with graphite, charcoal and antimony sulfide columns are described. The mechanism of the ruthenium removal process is discussed. It is concluded that although the graphite column process described is more efficient than a series of butex cycles in decontaminating uranium solutions from ruthenium, the engineering problems that would be involved weigh heavily in favor of the latter process. (auth)

6517 AERE-ES/R-2220
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE REMOVAL OF FISSION PRODUCTS FROM SOLUTION WITH A PRECIPITATOR-COLUMN TREATMENT. PART I. LABORATORY TRIALS. K. G. Seedhouse, J. Monahan, and G. Wallis. 1958. 36p. $0.90(BIS).

A synthetic effluent was treated in a Sludge Blanket Precipitator with 80 ppm PO_4, 40 ppm Fe^{3+}, at a pH of 11.5, being then passed through soil columns to achieve further activity removal. The decontamination in the Precipitator was 95 to 96%, the remaining activity consisting of 40% Ru and 60% Cs. All the Cs, and most of the Ru was removed in the columns, resulting in over 99% over-all removal of all the radioactivity. By employing long columns or columns in series, a decontamination factor of 10^3 can be achieved. Serious defects were observed with Nuneham Courtenay Greensand. These can partly be remedied by

conditioning with polyelectrolytes, quaternary ammonium compounds, and silicones. Vermiculite is to be tested as an alternative column adsorbent, its properties appearing to be ideal. Tests which are being made on the use of two precipitators, the second one employing a ferrous sulfide 'blanket' to remove Ru, are giving very promising results. (auth)

6518 CF-56-9-18

Oak Ridge National Lab., Tenn.

EXTRACTION OF THE ELEMENTS WITH TRIOCTYLPHOSPHINE OXIDE FROM ACIDIC SOLUTIONS. J. C. White. Sept. 6, 1956. 10p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

A preliminary survey is presented of the tri-n-alkylphosphine oxides in the analytical separation of metal ions by solvent extraction. (W.L.H.)

6519 HW-54759

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

NUCLEAR SAFETY IN THE PROCESSING OF SLIGHTLY ENRICHED URANIUM FUELS. N. Ketzlach, R. D. Cahoon, and R. L. Stevenson. Jan. 29, 1958. 10p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

A study was made of the criticality parameters in the processing of slightly enriched fuel elements. The criticality parameters for several processing schemes are presented. Some of the types of experiments necessary to evaluate the accuracy of theory are also suggested. (auth)

6520 IDO-14373(Del.)

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

PWR FUEL PROCESSING. W. H. McVey. Oct. 20, 1954. Decl. with deletions Mar. 14, 1957. 9p. Contract AT(10-1)-205. (CPP-54-102). $1.80(ph OTS); $1.80(mf OTS).

The feasibility of processing the PWR fuel was investigated. The two cases considered were a homogeneous core in which all the fuel pins are 2% enriched U alloyed with Mo and a seeded case in which natural U–Mo pins form the bulk of the core which is seeded with highly enriched sections of fuel. Since the feasibility depends on the chemistry of the system, more will have to be known of the dissolution chemistry of the U–Mo alloy, since all the Pu is in the natural or enriched U, the question of Pu processing also depends on the dissolution chemistry of U–Mo alloy. (F.S.)

6521 NAA-SR-2168

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

SEPARATIONS CHEMISTRY QUARTERLY PROGRESS REPORT [FOR] APRIL–JUNE 1957. G. E. Brand, A. G. Buyers, W. J. Gardner, E. E. Motta, and E. W. Murbach. Mar. 1, 1958. 37p. Contract AT-11-1-GEN-8. $1.25 (OTS).

A scale-up experiment was carried out to study the Pu extraction from molten U by UF_4. A test operation in which six slugs were cold-short fractured is described. The analytical results of a previous oxide-drossing experiment show the following fission-product removals: 98% Cs and Ce, 95% Te, over 99% rare earths and Sr, and 1% Ru. The results of investigations in which Th–U alloys were melted and held at temperatures several hundred degrees above the melting point show that the evaporation loss of Pa is from 24 to 36% and that of U is up to 14%. An experiment is described in which Th–U alloys was dip-induction melted. Experiments undertaken to determine the solubility of Th in molten Zn are described. The results of an electrolysis experiment in which irradiated Th–U was electrorefined using a molten salt bath and a liquid Zn cathode showed that 58% of the Zr, 79% of the Ce, 84% of the rare earths, 91% of the Ru, and greater than 99% of the Sr and Cs were removed. Experiments are described in which irradiated Th–U alloy was melted by induction heating and allowed to melt through frozen CaF_2. The results of these investigations show that greater than 80% of the Cs, Sr, and Te are removed. Ruthenium, Pa, Zr, and U losses were negligible. Thorium losses to the salt bed approached 12%. (For preceding period see NAA-SR-1997.) (W.L.H.)

6522 NYO-7927

Aeroprojects, Inc., West Chester, Penna.

APPLICATIONS OF ULTRASONIC ENERGY. Progress Report No. 7 Covering Period from December 1, 1957 to January 31, 1958. Feb. 1958. 50p. Contract AT(30-1)-1836. $7.80(ph OTS); $3.30(mf OTS).

Ultrasonic precipitations of thorium oxalate, carried out by the addition of solid oxalic acid to thorium nitrate solution, yielded smaller and more regularly shaped particles than did non-ultrasonic precipitations involving slow addition of oxalic acid solutions. The importance of digesting the precipitate and of thorough washing to remove excess reactants was emphasized. Preliminary experiments were undertaken in the reaction of solid thorium nitrate and oxalic acid with concomitant water addition and ultrasonic application. Studies were undertaken in the ultrasonic disintegration of composite fuel elements in mercury. Rapid erosion of Hastelloy C, stainless steel, mild steel, molybdenum, and graphite couplers indicate a problem in selection of an ultrasonic coupler material, although it may be possible to use a sacrificial coupler. Relatively short exposure resulted in extensive pitting and erosion of stainless steel sheet. The high erosion rates of the above materials indicate that such claddings may be effectively disrupted in mercury with applied ultrasonics. Ultrasonic leaching of cesium-bearing alumina waste with 0.01N nitric acid indicated a positive ultrasonic effect on rate of leaching in a continuous-flow or fixed-bed array. Undesirable breakup of the calcined waste pellets obtained under certain conditions suggests that non-cavitation leaching should be investigated. Investigation was initiated on ultrasonic application to the magnesium extraction of plutonium from uranium–chromium alloys. Preliminary studies in a room-temperature simulant system indicated high efficiency in emulsifying mercury in water and a substantially increased rate of extraction of copper from mercury with aqueous reagents. The possible use of a tantalum ultrasonic coupler will be investigated prior to tests with the actual system of interest. A theoretical evaluation and experimental program has been initiated on ultrasonic agglomeration of submicron radioactive particles in very dilute gas streams. A new approach, adding an aerosol of particles in the 2 to 10 μ size range of a suitable wetting agent and superimposing ultrasonic vibration, appears promising both theoretically and practically. The production of additive aerosol particles from a viscous non-evaporating surfactant liquid in this size range with the Aeroprojects atomization techniques has been demonstrated. (For preceding period see NYO-7926.) (auth)

6523 WIN-78

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

ACID LEACH RESIN-IN-PULP AND CCD SOLVENT EXTRACTION PILOT PLANT TESTING OF LAKEVIEW ORE. Test period: February 21 to May 30, 1957. W. A. Millsap and R. L. Shimmin. 55p. Contract AT(49-6)-924. $9.30 (ph OTS); $3.60(mf OTS).

Lakeview ore from the Lakeview mining district of Oregon was treated in the Acid Leach RIP Pilot Plant and

the Acid Leach–CCD–Solvent Extraction Pilot Plant at Grand Junction, Colorado. Both Lakeview Oxidized and Reduced Ores from the White King claim were tested. The report contains detailed information on grinding, leaching, sand-slime separation, countercurrent decantation, ion exchange, solvent extraction, and precipitation in connection with the processing of this ore. Results show the ores to be amenable to both processes. However, frequent regeneration of the resin would be required when treating Lakeview Reduced Ore in an Acid Leach RIP process. (auth)

6524

ELECTRO-CHROMATOGRAPHY IN THE SEPARATION OF IONS. PART V. SEPARATION OF THIRD GROUP METALS. A. K. Majumdar and B. R. Singh (Jadavpur Univ. Univ., Calcutta). Anal. Chim. Acta 18, 224-5(1958) Mar.

The ionic migration and migration sequences of the ions of group III, Fe^{+3}, Cr^{+3}, Al^{+3}, Be^{+2}, Ti^{+4}, Zr^{+4}, Th^{+4}, UO_2^{+2}, have been determined in a number of common electrolytes. Owing to their similar behavior towards ionic migration, besides separations from their binary and ternary mixtures, only a few separations from quaternary mixtures as Zr–Th–U–Be, Zr–Th–U–Al, Zr–Th–Al–Be, Zr–U–Al–Be, Ti–Th–U–Be, Ti–Th–U–Al, U–Zr–Al–Fe, and U–Th–Al–Fe are possible. (auth)

6525

SEPARATION OF THE ALKALINE EARTHS BY CHROMATOGRAPHY ON CELLUOSE COLUMN. J. Fouarge (Univ. of Liege). Anal. Chim. Acta 18, 225-30(1958) Mar.

6526

HYDROCLONE CENTRIFUGING REMOVES HOMOGENEOUS REACTOR FISSION PRODUCTS. W. D. Burch (Oak Ridge National Lab., Tenn.). Chem. Eng. Progr. 54, No. 2, 79-82(1958) Feb.

Insoluble corrosion and fission products are shown to be effectively removed by centrifugal separation in a hydraulic cyclone operated at reactor temperature and pressure. These insolubles comprise all corrosion products except nickel and approximately 70% of the fission products. A weekly batch purge of the recovered solids with 2% of the fuel solution keeps in balance the soluble fission and corrosion products. Over 1,000 hours of nonradioactive operation of the hydroclone system have demonstrated operability and established performance characteristics of the system. Data preliminary to radioactive operation, scheduled to begin about January 1, 1958, are reported. (auth)

6527

BATCH PROCESSING FOR KILOCURIE PRODUCTION OF BARIUM-140. A. L. Ayers and B. M. Legler (Phillips Petroleum Co., Idaho Falls, Idaho). Chem. Eng. Progr. 54, No. 2, 83-6(1958) Feb.

A new batch processing facility recovers kilocurie quantities of Ba^{140} from short-cooled MTR fuel. The process is based on the solubility characteristics of barium and barium salts in selected basic and acidic media. Several of the techniques used are probably applicable to other radiochemical recovery operations. A significant feature of the process is its unique ability to handle short-cooled fuels. (auth)

6528

Zr–Hf SEPARATION BY LIQUID-LIQUID EXTRACTION. Nadine Isaac and R. de Witte. Energie nucleaire 1, 71-6 (1957) Apr.-June. (In French)

The different known laboratory methods for the extraction of the nitrates of zirconium and hafnium by tributyl phosphate were examined. The preparation of these nitrates has led to the perfection of a simple and economic method of dissolution and chemical purification of a zirconium oxide of technical purity. A study of the technology of extraction columns was undertaken. The results obtained for the extraction of the sulfates of zirconium and hafnium by tributyl phosphate are discussed. (tr-auth)

6529

PILOT PLANT FOR PLUTONIUM EXTRACTION AT CHÂTILLON. RESULTS OF OPERATION. Pierre Faugeras and Pierre Regnaut. Energie nucleaire 1, 123-37(1957) July-Sept. (In French)

After a brief survey of plutonium extraction and its difficulties, the chemical processes and the apparatus used are described. Then the results obtained at different stages of the separation are discussed as well as the performance obtained from the apparatus. (tr-auth)

6530

EXTRACTION OF PLUTONIUM. P. Regnaut (Commissariat à l'Energie Atomique, France). Énergie nucléaire 1, 196-206(1957) Oct.-Dec. (In French)

After a brief survey of the formation of plutonium in piles, the difficulties of extracting it from irradiated uranium bars are reviewed. The different processes studied or used for the extraction are examined with the advantages and inconveniences of each indicated. (tr-auth)

6531

USE OF ION EXCHANGE RESINS FOR THE CONCENTRATION AND PURIFICATION OF URANIUM. Isabelle Prévot and Pierre Regnaut. Énergie nucléaire 1, 207-15(1957) Oct. Oct.-Dec. (In French)

During the Geneva Conference the French process for the extraction of plutonium from irradiated uranium was described. The different procedures used for the final concentration and purification was indicated but no details were given. The present article describes this final step in the treatment with special emphasis on the use of ion exchange resins. (tr-auth)

6532

PREPARING URANIUM TETRAFLUORIDE BY ION EXCHANGE AND ELECTROLYSIS. I. R. Higgins, J. T. Roberts, and C. W. Hancher (Oak Ridge National Lab., Tenn.) and J. A. Marinsky (Ionics Inc., Cambridge, Mass.). Ind. Eng. Chem. 50, 285-92(1958) Mar.

A detailed description of the Excer Process is given. The process is used for preparation of UF_4 from impure natural U in ore leach liquors, ore concentrates, or from reactor-irradiated U partially decontaminated by solvent extraction. (W.L.H.)

6533

HETEROGENEOUS ISOTOPIC EXCHANGE BETWEEN LIQUID MERCURY AND MERCUROUS IONS IN AQUEOUS SOLUTION. D. G. Tuck (Laboratorie Curie, Institut du Radium, Paris). J. chim. phys. 54, 896-901(1957) Nov.-Dec. (In French)

Previous works on the exchange reactions between liquid mercury and mercurous ions in aqueous solution furnish a value which is too low for the coefficient of self-diffusion of mercury, as direct measurements show. Therefore the speed of exchange was measured by the capillary technique; certain previous results were confirmed. It is shown that the processes controlling the speed is not the self-diffusion in the liquid mercury but the transport of an atom of mercury through the interface between the liquid metal and the aqueous phase. Some thermodynamic and steric aspects of this process of transfer are discussed. The proposed mechanism seems to be in accord with the other results concerning the oxide reduction reactions of mercury ions and the isotopic exchange reactions with amalgams. (tr-auth)

6534

HAFNIUM–ZIRCONIUM SEPARATION BY VAPOR PHASE

DECHLORINATION. J. W. Evans (The University, Manchester, Eng.). Trans. Met. Soc. AIME 212, No. 1, 55-6 (1958) Feb.

A method for the separation of Hf from Zr by vapor-phase oxidation of the purified mixed chlorides is presented. (W.L.H.)

6535

EFFECT OF ROASTING ON RECOVERY OF URANIUM AND VANADIUM FROM CARNOTITE ORES BY CARBONATE LEACHING. J. Halpern and F. A. Forward (Univ. of British Columbia, Vancouver, Can.) and A. H. Ross. Trans. Met. Soc. AIME 212, No. 1, 65-70(1958) Feb.

Application of the carbonate leaching process to carnotite ores has often been limited by the difficulty of obtaining simultaneous high recoveries of uranium and vanadium. The chemical aspects of this problem are discussed and the effect of prior roasting procedures on this recovery is described. (auth)

6536

RADIO PAPERCHROMATOGRAPHIC SEPARATION OF SMALL AMOUNTS OF RADIO VITAMIN $B_{12}(Co^{60})$ FROM INORGANIC Co^{60}. H. C. Heinrich and R. G. v. Heimburg (Universität Hamburg). Z. Med. Isotopenforsch. 1, No. 1, 46-53(1956) Nov. (In German)

A simple radiopaperchromatographic separation of small amounts of radio-vitamin B_{12} from Co^{60} is described for analytic and micropreparatory purposes using different solvents. The qualitative as well as quantitative interpretation of the paperchromograms was done by radiopaperchromographic technique. (auth)

6537

SEPARATION OF ALUMINUM AND ZIRCONIUM BY THE METHOD OF ION-EXCHANGE. Yu. I. Usatenko and L. I. Gureyeva. Zavodskaya Lab. 22, No. 7, 781-3(1956). (Translated from Referat. Zhur. Khim. No. 4, 1957, Abstract No. 12056).

The method is based on the fact that Zr is absorbed by the cathionite from more acidic solutions than Al. Greatest absorption power is exhibited by the cathionite KU-1 (maximum acidity 1.5 N); next best is cathionite SBSR (1.25 N); least absorption is shown by Wofatit R (0.75 N). Greatest difference in acidity for the absorption of Zr and Al is observed in the case of sulfonated coal, cathionite KU-1 and MOF-1. Al^{3+} ions are not absorbed by sulfonated coal from a 1 N, and by cathionite KU-1 from a 1.5 N, solution of the acid. Best results are obtained using sulfonated coal. The mixture of solutions of Al and Zr is passed through a column containing the cathionite at a rate of 5 ml/minute. Al is determined in the filtrate. Zr is leached out of the column with hydrochloric acid (1:4).

6538

RAPID DROP-DESORPTION METHOD FOR ISOLATION AND IDENTIFICATION OF SHORT-LIFE RADIOACTIVE ELEMENTS. K. V. Troitskiy. Zhur. Anal. Khim. 11, No. 4, 383-8(1956). (Translated from Referat. Zhur. Khim. No. 4, 1957, Abstract No. 12028).

A solution containing a mixture of different radioactive elements is placed on a piece of filter paper; as a carrier there is added a small amount of soluble salt of the element the radioactive isotope of which is being determined. After the solution has been absorbed by the paper the latter is treated with corresponding specific reagent; thus there is formed in the pores a finely dispersed precipitate (100 to 200 γ). To remove from the pores the extraneous radioactive elements, the paper is dried and immersed in a solution of acid; thereupon desorption takes place and the surface of the paper retains only the precipitate of the carrier with the radioactive element that is being determined. The method affords a number of advantages: formation of precipitates and desorption require 10 to 15 minutes; amount of carrier is 150 to 200 γ; use of organic reagents allows precipitates free from admixtures of extraneous radioactive elements to be obtained; thin, uniform layer of precipitate promotes more accurate measurement of activity; labor productivity of a chemist is increased by 5 to 10 times. The method is especially effective in the analysis of radioactive elements the half-life period of which is < 1 hour.

Transuranic Elements and Compounds

Refer also to abstract 6992.

6539 AERE-N/R-831

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE AVERAGE NUMBER OF NEUTRONS EMITTED IN THE SPONTANEOUS FISSION OF Pu^{240}. F. R. Barclay, W. Galbraith, and W. J. Whitehouse. Dec. 4, 1951. Decl. Oct. 7, 1955. 10p.

The average number (ν) of neutrons emitted in the spontaneous fission of Pu^{240} has been measured, by a method depending upon the device of counting only those neutrons which are detected immediately after the occurrence of a fission. In this way the effect of neutrons from sources other than spontaneous fission is entirely eliminated. The value found for ν is 2.84 ± 0.26 neutrons per fission. (auth)

6540 IGRL-T/W-63

PREPARATION OF METALLIC PLUTONIUM ON A GRAM SCALE. F. Anselin, P. Faugeras, and E. Grison. Translated by E. McCoy from Compt. rend. 242, 1996-8(1956). 4p.

Also issued as CEA-552.

This paper was previously abstracted from the original language and appears in Nuclear Science Abstracts, Vol. 10, as abstract No. 8448.

6541

DETERMINATION OF THE COMPOSITION AND INSTABILITY CONSTANTS OF Pu^{+3} OXALATE COMPLEXES. A. D. Gel'man, N. N. Matorina, and A. I. Moskvin. Atomnaya Energiya 3, No. 10, 308-13(1957).

The solubility of $Pu_2(C_2O_4)_3 \cdot 9H_2O$ in aqueous $K_2C_2O_4$ solution of various concentrations was measured at constant ionization of the solution and at a temperature of 20°C. Forming of Pu^{+3} complexes was proved, and the following ion complexes were formed: $[Pu(C_2O_4)_2]^-$, $[Pu(C_2O_4)_3]^{-3}$, and $[Pu(C_2O_4)_4]^{-5}$ with the instability constants 4.9×10^{-10}, 4.10×10^{-10}, and 11.9×10^{-11}, respectively. The solubility of $Pu_2(C_2O_4)_3 \cdot 9H_2O$ in an aqueous $(NH_4)_2C_2O_4$ solution at an ammonium concentration of 0.07 to 0.7 mole/l at a temperature of 70°C was also measured. The ion complexes and instability constants found are given. (T.C.O.)

6542

ION EXCHANGE BEHAVIOUR AND DISSOCIATION CONSTANTS OF AMERICIUM, CURIUM, AND CALIFORNIUM COMPLEXES WITH ETHYLENEDIAMINETETRA-ACETIC ACID. J. Fuger (Univ. of California, Berkeley). J. Inorg. & Nuclear Chem. 5, 332-8(1958).

Separation factors between californium, curium, and americium on ion exchange resin Dowex-50 X-12, in ammonium form, have been calculated from static equilibrations between pH 2 and pH 3.3 in presence of EDTA 10^{-3} M. They are found to be 2.04 ± 0.05 between americium and curium and 5.5 ± 0.1 between curium and californium. In the

experimental conditions, only 1:1 complexes are formed, and by ion exchange techniques, the dissociation constants are found to be equal to: californium: $10^{-15.09\pm0.2}$; curium: $10^{-16.45\pm0.1}$; americium: $10^{-16.16\pm0.1}$. Preliminary column experiments show that this complexing agent will be quite useful for separating actinide elements. (auth)

6543

NEPTUNIUM ISOTOPES: 234, 235, 236. J. E. Gindler, J. R. Huizenga, and D. W. Engelkemeir (Argonne National Lab., Lemont, Ill.). Phys. Rev. 109, 1263-7(1958) Feb. 15.

Neptunium isotopes of mass numbers 234, 235, and 236 were produced by an 18-Mev deuteron bombardment of uranium highly enriched in U^{235}. The radiations of Np^{235} were studied with scintillation and proportional counters in singles and coincidence. The L/K and M/L electron capture branching ratios of Np^{235} were measured to be 36.7 and 0.46, respectively. From the L/K ratio, the calculated decay energy of Np^{235} is 123 kev. An upper limit of 2.1% of the Np^{235} electron capture disintegrations populate excited states of U^{235}. The experimental data favor a spin of $5/2$ for Np^{235}. The alpha to electron capture ratio for Np^{235} is 1.59×10^{-5}, giving a partial alpha half-life of 7.0×10^4 years. The long-lived isomer of Np^{236} was produced in the bombardment, but no isomer of Np^{234} with half-life longer than two months was observed in a mass spectrometer analysis of the neptunium sample. (auth)

Tritium and Tritium Compounds

6544 UCRL-8056

California. Univ., Berkeley. Radiation Lab.

SYNTHESIS AND STORAGE OF SMALL QUANTITIES OF TRITIATED WATER. Irville M. Whittemore and Richard L. Lehman. Nov. 22, 1957. 9p. Contract W-7405-eng-48. $0.50(OTS).

A method that can be used to produce milliliter amounts of tritiated water from tritium gas is described. Safety precautions are emphasized as part of the method, which involves oxidation of tritium gas over hot copper(II) oxide in a sealed glass system. (auth)

Uranium and Uranium Compounds

Refer also to abstracts 6980, 6983, and 7016.

6545 AECD-3766

Union Carbide and Carbon Research Labs., Niagara Falls, N. Y.

MEMORANDUM ON URANIUM ORE PROCESSING. E. O. Brimm and A. J. Gailey. Nov. 19, 1943. Changed from OFFICIAL USE ONLY Jan. 31, 1957. 7p. $1.80(ph OTS); $1.80(mf OTS). (M-4759).

Preliminary experimentation at Uravan confirmed previous work by the United States Vanadium Corporation, Electro Metallurgical Company, and Linde Air Products Company and indicated that leaching ore with Na_2CO_3 solutions extracted about 90% of the U_3O_8 and 10% of the V_2O_5. Solutions from the above type of leaches were neutralized with H_2SO_4 and precipitated with Na_2CO_3 to give a crude Na uranate analyzing 70 to 75% U_3O_8 and 10 to 20% V_2O_5 with good recoveries of both metals. (auth)

6546 AECD-3767

Union Carbide and Carbon Research Labs., Niagara Falls, N. Y.

EXPERIMENTATION ON THE EXTRACTION OF URANIUM FROM WESTERN ORES. 1. PRESSURE DIGESTION TESTS WITH SODIUM CARBONATE AND SODIUM BICARBONATE. 2. PRECIPITATION TESTS. E. R. Saunders and M. C. Carosella. Dec. 27, 1943. Changed from OFFICIAL USE ONLY Jan. 23, 1957. 10p. $1.80 (ph OTS); $1.80(mf OTS). (M-4757).

Previous reports have described work on Colorado carnotites in which over 90% of the U and 15% of the V were extracted by boiling Na_2CO_3 solutions with alkali usages of 80 to 120 lbs/t of ore. The present report describes a number of tests in which leaching temperatures of 115°C and 125°C were tried. Equally good extractions were obtained at 115°C (10 psi) with about 30% less alkali than was required at 100°C. The tests at 125°C (30 psi) did not show any advantage over the 115°C tests. A 2-stage, countercurrent digestion at 115°C with a net soda ash usage of 60 lbs/t of ore gave an extraction of over 90% of the U. On an equal weight basis $NaHCO_3$ was not so effective as Na_2CO_3. The results of several precipitation tests are given. U precipitation was complete on acidifying the carbonate solution to a pH of 5.0. Further acidification to about a pH of 3.0 was necessary to completely precipitate the V. Precipitation of the U directly from the carbonate solution required a very large excess of NaOH (7.5 grams/gram of U_3O_8). (auth)

6547 IDO-16419

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

DISTRIBUTION OF U^{232} IN AN IRRADIATED THORIUM SLUG. R. G. Nisle and E. Fast. Oct. 21, 1957. 16p. Contract AT(10-1)-205. $0.50(OTS).

An irradiated thorium slug was cut up and representative sections analyzed mass-spectrographically to obtain the distribution of U^{232} within the slug. The slug received an estimated 10^{21} nvt during an irradiation period of about one year, followed by a cooling period of $3\frac{1}{2}$ years. Radial distribution of U^{232} varied from 0.40 wt. % near the surface to about 0.33 at the center. The relative concentration of U^{234} and U^{235} was greatest near the surface. The observed distribution of U^{232} agrees reasonably well with the simple diffusion theory based on a first order approximation to the buildup of U^{232} in thorium. (auth)

6548 MCW-121

Mallinckrodt Chemical Works, St. Louis.

REACTION RATE OF THE FLUORINATION OF URANIUM DIOXIDE AT A CONTINUOUSLY INCREASING TEMPERATURE. C. W. Kuhlman. July 19, 1948. Decl. Feb. 26, 1957. 7p. $0.25(OTS).

Using an apparatus described in a preceeding paper the reaction rate of the fluorination of UO_2 by HF was measured under the condition of a gradually increasing temperature. UF_4 made in this way did not show caking although final reaction temperatures ranged as high as 700°C. The rate of reaction was found to be greater than the rate measured under isothermal conditions at the highest temperature attained during the continuous increase as long as this final temperature was above 550°C. (auth)

6549 ORNL-1885(Del.)

Oak Ridge National Lab., Tenn.

A FUSED SALT–FLUORIDE VOLATILITY PROCESS FOR RECOVERY AND DECONTAMINATION OF URANIUM. G. I. Cathers and M. R. Bennett. Oct. 10, 1955. Decl. with deletions Feb. 28, 1957. 24p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

A preliminary chemical flowsheet is presented of a fluoride volatility process for recovering and decontaminating U from heterogeneous reactor fuels after dissolution in a fused salt. In laboratory work, a gross β decontamination factor of $>10^4$ was obtained in the fluorination of a UF_4–NaF–ZrF_4 melt by passing the product UF_6 through NaF at 650°C. The solubility of UF_6 in molten NaF–ZrF_4

was shown in kinetic studies to cause a lag in the evolution of UF_6 from the fluorinator. Corrosion of nickel in the fluorination step appeared to be 2 to 4 mils/hr during the time that U was present. The average corrosion rate over the process as a whole was less than 0.4 mil/hr. (auth)

6550 ORNL-2367

Oak Ridge National Lab., Tenn.

CRITICAL MASS STUDIES. PART IX. AQUEOUS U^{235} SOLUTIONS. J. K. Fox, L. W. Gilley, and D. Callihan. Mar. 4, 1958. 57p. Contract W-7405-eng-26. $1.75(OTS).

Experiments were performed to determine the conditions under which aqueous solutions of U enriched to 93.2% in the U^{235} isotope can be made critical. The solutions, which had H: U^{235} atomic ratios varying between 27.1 to 74.6, were contained both in water-reflected and unreflected Al or stainless steel cylinders with and without Cd wrappings. The experiments varied from the use of a single vessel to interacting arrays of seven vessels. (auth)

6551 ORNL-2401

Oak Ridge National Lab., Tenn.

KINETICS OF THE THERMAL DECOMPOSITION OF URANYL FLUORIDE. I. PRELIMINARY RESULTS. L. M. Ferris and E. F. Gabbard. Mar. 5, 1958. 23p. Contract W-7405-eng-26. $0.75(OTS).

The thermal decomposition of uranyl fluoride was studied by a thermogravimetric technique between 750 and 880°C. The decomposition reaction at atmospheric pressure is $3\ UO_2F_2 \rightarrow 2/3\ U_3O_8 + UF_6 + 1/3\ O_2$. In dry helium the rate of reaction was first order with respect to the mass of UO_2F_2, with indications that it also was dependent on the gas flow rate. The rate constants, determined with a constant flow rate of dry helium, may be expressed as $\log k\ (min^{-1}) = 11.57 - 15700/T$. In preliminary experiments with dry air and oxygen the rate decreased with increasing oxygen partial pressure; however, data were insufficient for a quantitative relation to be derived. UO_2F_2 sublimed, as a parallel first-order process, at temperatures above 825°C. (auth)

6552 WAPD-TM-99

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

CALCULATED EQUILIBRIUM CONSTANTS FOR METAL–OXYGEN REACTIONS IN MOLTEN URANIUM ALLOYS. E. H. Roland. Nov. 1957. 17p. Contract AT-11-1-GEN-14. $0.75(OTS).

The equilibrium constants for oxidation reactions occurring in molten U alloys are estimated from thermodynamic principles. Preliminary qualitative information was provided on: the relative ability of various elements to deoxidize U, and the relative stability of the oxide formed as a result. The latter will guide in the selection of oxides as possible crucible materials. Ideas were obtained on possible purification of U by melting. (M.H.R.)

6553 WASH-295(Del.)

Division of Research, AEC.

URANIUM ALLOY NEWSLETTER NO. 13. [Edward Epremian, ed.]. Nov. 1955. Decl. with deletions Mar. 5, 1958. 50p. $7.80(ph OTS); $3.30(mf OTS).

Argonne National Lab. Results are summarized from irradiation and corrosion tests on alloys of U–Pu, U–Nb–Sn, and U–Zr–Nb, and U–Si systems. Armour Research Foundation. Studies of the transformation kinetics of U-base alloys have been completed, and results are summarized. TTT diagrams are presented for 2 Nb–U alloys. Battelle Memorial Inst. Phase studies, heat treatment studies, and preparation of U–Zr alloys are described. The study of the properties and preparation of various U alloys for use as fuel elements are continuing. Techniques for melting and casting Al–U alloys and for melting U–Zr alloys are being developed. Hanford Atomic Products Operation. Results of metallographic and phase studies on U–Th alloys are reported. The corrosion resistance of several Th–U–Zr alloys has been studied. National Bureau of Standards. The preparation and phase relations of alloys of U with the platinum metals are being studied. North American Aviation, Inc. The feasibility of fabricating specific U alloys for fuel elements on a semi-production scale is being investigated. Nuclear Metals, Inc. Studies of the thermal properties of U–Nb–Zr alloys and of the corrosion of U–Si systems are reported. Fabrication behavior and microstructures in cast, extruded, and heat treated U alloys are being examined. Sylvania Electric Products, Inc. Data are presented on the mechanical properties and dimensional stability under thermal cycling of various powder metallurgy binary U alloys. Corrosion rates in water and densities are reported of some powder metallurgy Si–U systems. Westinghouse Atomic Power Div. The changes in dimensions, density, electrical resistivity, and hardness of irradiated U–Mo and U–Nb alloys are tabulated. The effects of irradiating prototype fuel rods of U and U–Zr alloy are reported. (W.L.H.)

6554

PREPARATION AND PROPERTIES OF URANIUM DIOXIDE POWDER. C. D. Harrington and A. E. Ruehle (Mallinckrodt Chemical Works, St. Louis). Chem. Eng. Progr. 54, No. 1, 65–70(1958).

Commercial preparation of UO_2 is described with emphasis on the two methods which have had wide application in the actual production of the dioxide for fuel element raw material. Physical properties of UO_2 powder are related to their importance in fuel element use. (auth)

6555

CHEMICAL TREATMENT OF LOW-GRADE URANIUM MINERALS. Robert Sartorius (Commissariat a l'Energie Atomique, Paris). Energie nucleaire 1, 3–10(1957) Jan.–Mar. (In French)

The economic problems of the extraction of uranium are studied in connection with the mineral grade. Then the methods of chemical treatment which can solve these problems are examined. (tr-auth)

6556

PRODUCTION OF THE TETRAFLUORIDES OF URANIUM AND OF THORIUM. Alberto Cacciari, Carlo Fizzotti, Mario Gabaglio, and Ruggero de Leone (CNRN-CISE, Milan). Energie nucleaire 1, 11–16(1957) Jan.–Mar. (In French)

Two methods of preparation of the tetrafluorides of uranium and thorium are described which are different from those already known and used for their industrial preparation. The agents of fluorination are Freon 12 (CF_2Cl_2) for uranium and Freon 12 and aqueous solutions of ammonium acid fluoride (NH_4HF_2) for thorium. (tr-auth)

6557

CHEMICAL ENRICHMENT OF LOW-GRADE URANIUM CONCENTRATES. Paulo Marrecas Ferreira (Junta de Energia Nuclear, Lisbon). Energie nucleaire 1, 63–6 (1957) Apr.–June. (In French)

Chemical methods were studied for the enrichment of low-grade uranium concentrates obtained by sulfuric acid dissolution of the mineral followed by precipitation with lime or magnesia. The preparation of these concentrates with less than 25% U_3O_8 for organic solvent extraction with nitric acid dissolution is not economically feasible unless enriched concentrates are added to the mixture. Uranium can be extracted with 10% excess sodium carbonate in an autoclave at a temperature of 110° and a pressure of 0.7 atm. The uranium is then precipitated by an adjustment of

the pH with sodium bicarbonate. An efficiency of 99% is obtained. (tr-auth)

6558

PREPARATION OF URANIUM OXIDES WITH DIFFERENT DENSITIES. B. Tougarinoff. Énergie nucléaire 1, 67-70 (1957) Apr.-June. (In French)

The oxides of uranium obtained by the three processes used in industry (by precipitation of the peroxide UO_4, precipitation of the ammonium uranate $(NH_4)_2U_2O_7$, and thermal decomposition of the nitrate $UO_2(NO_3)_2$) are compared on the basis of their apparent densities. The specific gravity varies from 1.5 to 4.5 according to the operating conditions. The oxide UO_3, the most dense, is obtained by rapid decomposition of uranyl nitrate. The same procedure can be used for the production of light oxides by the introduction of ammonia into the decomposition apparatus. (tr-auth)

6559

THE MINE AND PLANT AT L'ECARPIERE. Energie nucléaire 1, 150-4(1957) July-Sept. (In French)

The mine and the ore processing plant at Ecarpière are described. The chemical processes used for the concentration of uranium are outlined. (J.S.R.)

6560

THE EXTRACTION OF URANIUM BY A CENTRIFUGE EXTRACTOR. A. De Troy (Societe Generale Metallurgique de Hoboken, Belgium). Energie nucléaire 1, 191-5(1957) Oct.-Dec. (In French)

For the industrial realization of uranium purification by liquid-liquid extraction, a centrifuge extractor with three stages operating with counter current was adopted. The extraction conditions of this apparatus can be varied within large limits which are defined. The production realized in the application of appropriate operating methods are indicated for an extractor with a three liter capacity. The efficiency of extraction is discussed. (tr-auth)

6561

URANIUM ORE REDUCTION. THE FRENCH PROCESS. Maurice Moyal. Nuclear Power 3, 125-7(1958) Mar.

A flowsheet of the methods used in France at the Le Bouchet plant for the reduction of U ores is given. Three stages of treatment are used: the ore concentrate is converted to sodium uranate, the uranate is processed into the oxide, and the oxide is reduced to the metal. Uranium from the plant has a purity of 99.999%. (J.S.R.)

Waste Disposal

6562 HW-41791(Pt. 1)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

PUREX WASTE STORAGE. PART I. 241-A WASTE STORAGE FACILITIES. G. L. O'Neill and W. H. Swift. Mar. 7, 1956. 20p. Contract [W-31-109-Eng-52]. $4.80 (ph OTS); $2.70(mf OTS).

Storage of the fission products separated from the product streams of the Purex process is being accomplished using a smaller volume of accompanying solution than any other process here-to-fore used at HAPO. The operating technique and control mechanisms which are needed to store large quantities of these highly radioactive wastes are not as yet fully understood, but considerable insight into the problem has been gained from the experience at Redox during the last 36 months. The basic intentions of the 241-A Storage Facility design is to control the boiling wastes by providing suitable tanks to contain the liquid and a vapor system provided with suitable seals to control the vapors. This document (Part I) will present a somewhat detailed description of the Purex Storage Facility, and a review of the activities there before plant start-up. Part II, published under separate cover, contains a description of Waste Farm Technology including a process description and a recommended plan for operation. (auth)

6563 ORNL-224

Oak Ridge National Lab., Tenn.

PILOT MODEL EVAPORATOR FOR CONCENTRATION OF RADIOACTIVE CHEMICAL WASTES. S. E. Beall. Feb. 7, 1949. Decl. Mar. 19, 1957. 33p. Contract W-7405-eng-26. $0.40(OTS).

A scale model of an evaporator designed for concentration and decontamination of radiochemical wastes was installed and operated for two weeks. Satisfactory operation of the designed system is predicted by the experiment which indicates: an over-all heat transfer coefficient at 150 to 250 Btu/hr-ft^2-°F; no scaling in acid solutions; evaporation rates greater than the required 12.8 lb/hr-ft^2 heating surface; decontamination factors greater than 10^3 and perhaps as high as 10^5 (exclusive of iodine). (auth)

6564

THE PRINCIPLES OF WASTE DISPOSAL FROM NUCLEAR POWER STATIONS. John D. Abbatt and B. D. Willson. Atomic Energy Rev. 1, 106-9(1957) Sept.

6565

SOME STUDIES APPLICABLE TO THE CHEMICAL TREATMENT OF RADIOACTIVE EFFLUENTS. P. Dejonghe and M. D'Hont. Energie nucléaire 1, 27-33(1957) Jan.-Mar. (In French)

The removal of ruthenium from radioactive water residues by ferrous sulfate was studied. Better results are obtained than from flocculation or precipitation. The removal of hexavalent uranium is accomplished with equally good results by the use of tannic acid or sodium phosphate. The effect of versene on the removal of radioactive materials was considered. It was found that versene interferes considerably, but it is possible to diminish its interference by means of potassium permanganate. Finally, the treatment of radioactive effluents with sawdust was investigated. The results showed that the adsorption on sawdust is a simple, efficient, and inexpensive method for the treatment of very large quantities of radioactive wastes. (J.S.R.)

6566

THE FIXATION OF STRONGLY RADIOACTIVE RESIDUES IN SOLID FORM. C. B. Amphlett (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Énergie nucleaire 1, 80-8(1957) Apr.-June. (In French)

Radioactive particles in residual solutions can be fixed by mixing with appropriate silicious materials (for example, earth, clay, or natural silicates) and firing at high temperatures to obtain a ceramic product which is resistant to attack by water or aqueous solutions. A flux can be added, if necessary, to lower the fusion temperature without affecting the fixation of the activity. Except in the case of ruthenium in certain conditions, the loss of activity during the firing is negligible. This method is more flexible than the ion exchange method and allows the processing of sediments and solid materials as well as solutions. The two processes are compared with respect to remote control in the case of high activities, and the work necessary to improve the ceramic process is briefly outlined. (tr-auth)

6567

INFLUENCE OF SOME DECONTAMINATING AGENTS ON THE PURIFICATION OF RADIOACTIVE RESIDUAL WATER. J. Cantel and P. Cohen (Centre d'Etudes nucléaires de Saclay, France). Energie nucleaire 1, 138-40 (1957) July-Sept. (In French)

The effect of different decontamination agents on the efficiency of the treatment of radioactive effluents was studied. Versene, often used as a decontaminant, does not impede the efficiency of the chemical treatment used. (tr-auth)

6568

THE BEHAVIOUR OF RADIOISOTOPES IN SEWAGE TREATMENT AND THE DISPOSAL OF RADIOACTIVE WASTES TO SEWERS. A. W. Kenny. J. Brit. Nuclear Energy Conf. 2, 341-50(1957) Oct.

The paper discusses the general principles on which maximum permissible levels of irradiation are fixed and shows that with present usage of radioisotopes these levels are not exceeded. Consideration is given to contamination of drains, hazard to workers in sewers and at sewage-disposal works, and the effect of radiation on sewage-purifying organisms. The behavior of certain radioisotopes during sewage purification, the discharge of radioactive sewage effluent to rivers, and the concentration of radioisotopes in sewage sludge are discussed. (auth)

ENGINEERING

Refer also to abstracts 7006, 7008, 7009, 7011, and 7012.

6569 UCRL-3687

California. Univ., Berkeley. Radiation Lab.

UCRL DESIGN DATA OF GENERAL INTEREST. W. M. Brobeck and D. T. Scalise. Sept. 1957. 102p. Contract W-7405-eng-48. $2.75(OTS).

Mechanical engineering data prepared and used at UCRL in design work are summarized. (M.H.R.)

6570

THE CHOICE OF STRUCTURAL MATERIAL FOR NUCLEAR POWER STATIONS. Charles E. Reynolds (Simon-Carves, Ltd., London). Atomic Energy Rev. 1, 72-7(1957) Sept.

A discussion is presented on the choice of structural materials such as steel and concrete for nuclear power stations. The factors considered are the costs, availability, durability, maintenance, fire resistance, watertightness, and resistance to corrosion. (W.L.H.)

Heat Transfer and Fluid Flow

6571 AECD-4259

[Los Alamos Scientific Lab., N. Mex.]

HEAT TRANSFER CHARACTERISTICS OF GRAPHITE PLATES WITH HYDROGEN COOLANT. R. W. Bussard and F. P. Durham. Oct. 19, 1955. Decl. Mar. 3, 1958. 88p. Contract [W-7405-eng-36]. $13.80(ph OTS); $4.80 (mf OTS).

This note presents the results of a parametric study of heat-generating graphite plates with hydrogen coolant flowing through constant area passages. The heat generation within the graphite was assumed to have a distribution that allowed the centerline temperature of the plates to remain constant at 5000°F. The parametric variables were the mass flow rate per unit area, plate thickness, plate length, and passage hydraulic diameter. (auth)

6572 DP-262

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

HEAT FLUX AT BURNOUT IN STAGNANT WATER. S. Mirshak. Dec. 1957. 11p. Contract AT(07-2)-1. $0.50 (OTS).

The heat flux required to melt vertical tubes of stainless steel, submerged in stagnant water at atmospheric pressure, was measured as the temperature of the ambient water was varied from 10 to 100°C. The heat flux in Btu/hr-ft^2 was correlated by $(Q/A)_{Burnout} = 204{,}000 + 3{,}900\Delta t$ where Δt is the difference between the normal boiling point and the temperature of the ambient water. (auth)

6573 GEAP-1076

General Electric Co. Atomic Power Equipment Dept., Schenectady, N. Y.

STEAM SLIP AND BURNOUT IN BULK BOILING SYSTEMS. A. E. Galson. June 5, 1957. 21p. $4.80(ph OTS); $2.70(mf OTS).

In concurrent flow of two phase mixtures there exists a velocity difference between the vapor and liquid phases. This difference in velocity is known as the slip velocity. The prediction of slip is the subject of Part I. In boiling systems there is some heat transfer rate at which nucleate boiling becomes unstable. At this point the separate bubbles coalesce forming an insulating vapor film on the heat transfer surface resulting in the destruction, or burnout, of the heater. The prediction of the conditions causing burnout is the subject of Part II. (auth)

6574 ISC-909

Ames Lab., Ames, Iowa.

SIMULTANEOUS SINGLE ELEMENT AIR TEMPERATURE AND VELOCITY MEASUREMENTS. James E. Benjamin and R. W. Fahien. June 1957. 66p. Contract W-7405-eng-82. $1.75(OTS).

Equations were derived for measuring gas velocity and temperature simultaneously using a single heated platinum wire as the sensing element. These equations contained four unknown coefficients which were considered constant. These constants were to be determined by calibrating at two known levels of temperature and velocity. The method of measuring required numerical values for the current and voltage drop in the wire and the derivative of the voltage with respect to the current. These were achieved by plotting curves of current versus voltage with an X-Y plotter and taking slopes from the resultant curves. Calibration was attempted on an instrument consisting of concentric platinum wire loops mounted in a vertical 4-inch pipe which had heated air flowing upward through it. Equipment and procedure of the calibration are given in detail. From the values obtained for the four calibration "constants" found at three levels of gas temperature and velocity and three levels of resistance, it was concluded that the theory was oversimplified in assuming constancy of these coefficients. However, it was felt that determination of the relationships between the four coefficients and the system parameters would make this means of measurement possible though complicated. A vivid graphic portrayal of the degree of turbulence in "laminar" and turbulent flow was also demonstrated. (auth)

6575 NDA-13

Nuclear Development Corp. of America, White Plains, N. Y.

BOILING BURNOUT PROGRESS [Issue] No. 6. (Unclassified Section). (15J-9). John E. Viscardi, ed. Aug. 29, 1955. 6p. Contract AT(30-1)-862. $1.80(ph OTS); $1.80(mf OTS).

A study was made of nucleate boiling, film formation, and burnout for a one-mil tungsten wire heated by the superposition of impulse and d-c heating in water at 200°F and at atmospheric pressure. In this study nucleate boiling is distinguished from film boiling by the characteristic bubble formation without a knowledge of the wire surface temperature. Film boiling is recognized when a continuous film covers all the surface of the wire in the field of view. (W.L.H.)

6576 NP-6594
North Carolina State Coll., Raleigh.
HEAT TRANSFER FLUIDS FOR NUCLEAR POWER GENERATION. Literature Abstracts (1947–1957). Jan. 15, 1958. 173p. Contract Nonr-486(03).

This report presents abstracts of articles pertaining to those heat transfer fluids suitable for application to nuclear power generation. Literature search was carried back to 1947. Full use was made of the Engineering Index, the Chemical Abstracts and the Nuclear Science Abstracts. Classified material was avoided in the preparation of this report to permit wider distribution. (auth)

6577 NRL-4967
Naval Research Lab., Washington, D. C.
THE FEASIBILITY OF USING WHOLLY EXTERNAL ULTRASONICS TO MEASURE FLUID FLOW WITHIN THICK-WALLED METAL PIPES. V. A. Del Grosso and E. M. Spurlock. May 29, 1957. 42p.

A review of the literature concerning flowmeters utilizing sound waves disclosed none capable of operation through thick pipe walls. Because there are several applications for such a device, three pulsed ultrasonic systems to measure the flow of a pressurized liquid within a thick-walled pipe, with all equipment external to the pipe, are formulated. Based on elementary principles, the relative advantages and disadvantages of these proposals are indicated. A two-crystal, two plane-parallel plug configuration is described in detail. Because of unanticipated problems which arose when a pipe was modified for this proposal, a four-crystal, four plane-parallel plug configuration was investigated. In order to avoid niches on the interior pipe wall, a refraction scheme was also considered, but this was abandoned because of the ensuing complicated equations. A block diagram for the electronics system is suggested, including a scheme to minimize the effect of sound speed on the flow indication for the first two configurations. A scheme for the mechanical construction associated with the first two configurations is presented. Problems warranting further experimental work are interspersed throughout the report. (auth)

6578 PIBAL-407
Brooklyn. Polytechnic Inst.
TURBULENT FLOW IN CHANNELS WITH POROUS WALLS. S. W. Yuan. Aug. 1957. 14p. Project No. NR 094-342. Contract Nonr-839(16).

The problem of two-dimensional turbulent flow in channels with two equally porous walls has been investigated. An exact solution of the Reynolds equations, reduced to a third order non-linear differential equation with appropriate boundary conditions, is obtained. The axial velocity distribution is expressed as functions of velocity through porous walls; the axial pressure gradient and the empirical constant K. The axial velocity distributions have been also obtained from the simplified Reynolds equation. (auth)

6579 SC-4138(TR)
Sandia Corp., Albuquerque, N. Mex.
AERODYNAMIC HEATING SOLUTIONS FOR A TYPICAL MISSILE DETERMINED FROM THREE TURBULENT BOUNDARY LAYER THEORIES. W. M. Burley, Jr. Aug. 30, 1957. 38p. Contract [AT(29-1)-789]. $6.30(ph OTS); $3.00(mf OTS).

Aerodynamic heating inputs and resulting skin temperatures for a missile with flight Mach numbers from 1.5 to 6.0 were computed on the REAC. The results, determined from three different boundary layer theories, are to be used as an aid in the design of a radiation facility to simulate aerodynamic heating inputs. The three theories yielded maximum skin temperatures as follows: Van Driest's cone theory, 1935°R, Van Driest's flat plate theory, 1875°R, and an MIT theory, 1830°R. Van Driest's cone theory results are recommended for design values. (auth)

6580 UD-FB-13
Delaware. Univ., Newark.
HEAT TRANSFER TO BOILING LIQUIDS UNDER CONDITIONS OF HIGH TEMPERATURE DIFFERENCE AND FORCED CONVECTION. Final Technical Report. S. Rankin. Feb. 20, 1958. 94p. DA Project No. 5B99-01-004. Contract DA-36-034-ORD-1797.

Heat transfer coefficients have been determined for forced convection film boiling under conditions of high temperature difference. The results should be of value in design of cooling systems where large and variable heat fluxes are encountered. The studies were made with two different liquids, Freon-113 and methanol. Data were obtained at entering liquid velocities of from 1.0 to 8.5 ft/sec, and with wall-to-fluid temperature differences which ranged from a maximum of 320°F down to values around 80°F where nucleate boiling was encountered. Peak heat flux data and pressure drop data were also obtained in most cases. The heat transfer coefficients varied from around 58 Btu/(hr)(deg.F.)(sq.ft.) at the lowest temperature differences to around 44 Btu/(hr)(deg.F.)(sq.ft.) at the highest temperature differences. The effect of entering liquid velocity was quite small. An equation has been derived for prediction of the coefficients of heat transfer for this case. The experimental results yield heat transfer coefficients which are about twice as large as those predicted by the derived equation. This seems to indicate that the flow of vapor in the vapor film was turbulent. The degree of stability of the vapor film was examined. A mathematical derivation is presented to show that vapor repulsion forces are sufficient to provide for a stable interface under any velocity condition. (auth)

6581 WAPD-TH-348
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]
HEAT TRANSFER AND VELOCITY PROFILE NEAR THE CORNERS OF RECTANGULAR CHANNELS. W. H. Bell and B. W. LeTourneau. July 31, 1957. 7p. $1.80(ph OTS); $1.80(mf OTS).

Naphthalene mass transfer-heat transfer analogy tests are reported which indicate no reduction in the film coefficient of heat transfer to within 0.05 channel thickness of the corner of a rectangular channel in a fusion-welded type subassembly. Velocity traverses in a similar rectangular channel indicate a significant velocity reduction starting about 1 channel thickness from the corner. This apparent contradiction is explained, and the application of these data to reactor design is considered. (auth)

6582 NACA-TM-1408
THE PRINCIPLES OF TURBULENT HEAT TRANSFER. (Die Grundlagen des Trubulenten Wärmeuberganges). H. Reichardt. Translated by S. Reiss from Arch. ges. Wärmetech. 2, 129-42(1951). 45p.

Relations are derived for calculating heat-transfer coefficients for turbulent and laminar fully developed flow and heat transfer in pipes and channels at constant wall temperature. Nusselt numbers for a round pipe are computed for Prandtl numbers from 0 to 1000 at a Reynolds number of 30,000. The eddy diffusivity of momentum is assumed to vary in a continuous manner from the wall to the center of the channel. For very high Prandtl numbers it is postulated that the eddy diffusivity of momentum varies with the fifth power of the distance from the wall when very close to the wall. (auth)

6583 NP-tr-41
A MULTIPLY-BENT TUBE AS A MODEL FOR A POROUS

SYSTEM — MOLECULAR FLOW WITH AND WITHOUT ADDED GAS. J. W. Hiby and M. Pahl. Translated by M. H. Rand from Z. Naturforsch. 11a, 80-4(1956). 16p.

A formula is derived for molecular gas flow through a multiply bent tube. (W.L.H.)

6584

HEAT-TRANSFER EXPERIMENTS ON FUEL-ELEMENT CANS. E. W. V. Acton (General Electric Co., Wembley, Eng.). Atomic Energy Rev. 1, 84-90(1957) Sept.

The object of the experiments is to determine how the volume of the canning materials permitted by nuclear considerations may best be used to obtain the greatest possible heat release from the fuel, at a given temperature and with an economical expenditure of blower power. (W.L.H.)

6585

LAMINAR FLOW IN AN ANNULUS WITH POROUS WALLS. Abraham S. Berman (Union Carbide Nuclear Co., Oak Ridge, Tenn.). J. Appl. Phys. 29, 71-5(1958) Jan.

When certain restrictions are applied to the radial component of flow it is possible to obtain an exact solution to the Navier-Stokes equations describing the steady-state flow of an incompressible fluid in an annulus having porous walls. The effects of such restricted radial flows on the characteristics of the flow field have been examined. (auth)

Materials Testing

Refer also to abstract 7033.

6586 AECU-3644

Westinghouse Electric Corp., East Pittsburgh, Penna. INVESTIGATION OF BEARING SURFACES USING THE ELECTRON MICROSCOPE. Materials Engineering Report No. 5711-6143. P. H. Bowen. Nov. 29, 1957. 38p. $6.30(ph OTS); $3.00(mf OTS).

A test indicated that life of a submersed water lubricated reactor bearing may have been increased when molybdenum wire was in contact with the bearing cage. In an effort to better understand this and other lubrication phenomena, the electron microscope was used to investigate the surfaces of a new bearing race and that of two other races after their immersion in water containing an additive of ammonium molybdate. Results indicated that the microscopy technique was satisfactory for the study of the surface microroughness of bearing races and may be extended to cover surface studies of bearings functionally operated in various lubricants. (auth)

6587 WADC-TN-57-229

Inland Testing Labs., Morton Grove, Ill. BIBLIOGRAPHY: FORMULATION OF AN ENVIRONMENTAL TESTING PHILOSOPHY FOR ANP WEAPON SYSTEMS. P. M. Van Arsdell. June 30, 1957. 213p. Project No. 7112. Contract AF33(616)-3912. (AD-130775).

This report is the result of a systematic review of over 10,000 documents and presents a comprehensive cataloged and cross-indexed bibliography of presently available information on radiation damage to various materials. Over 2000 references are compiled on all facets of radiation effects and radiation sources. It is believed that this information will provide an invaluable source for any future work contemplated in the field of radiation effects on materials. (auth)

6588

A HIGH-TEMPERATURE CENTRIFUGE FOR CREEP, RUPTURE, AND BEND TESTS. I. I. Kornilov (A. A. Baikov Metallurgical Inst., Moscow). J. Metals 10, 187-9 (1958) Mar.

A high-temperature centrifuge for creep, rupture, and bend tests is described. The use of this method permits the simultaneous testing of a large number of specimens 100 mm long, 3 to 4 mm in diameter, and weighing 5 to 10 g at temperatures up to 1200°C. The stress conditions and the applications of this instrument are discussed. Typical experimental information is given. (J.S.R.)

6589

A CRITICAL SURVEY OF THE GENERAL LIMITATIONS OF THE NONDESTRUCTIVE TESTING FIELD. D. W. Ballard (Sandia Corp., Albuquerque, N. Mex.). J. Soc. Non-Destructive Testing 15, 198-207(1957) July-Aug.

A general survey of limitations in the field of nondestructive testing are described in detail. (W.L.H.)

Pumps

Refer to abstracts 7007 and 7010.

Waste Disposal

6590

DISCUSSIONS ON THE ATOMIC INDUSTRY WASTE DISPOSAL INTO THE BLACK SEA. V. A. Vodyanitskii. Priroda 47, No. 2, 46-52(1958) Feb. (In Russian)

MINERALOGY, METALLURGY, AND CERAMICS

Ceramics and Refractories

Refer also to abstracts 7014, 7015, and 7017.

6591 CEA-675

France. Commissariat à l'Énergie Atomique, Paris. DETERMINATION DE LA REDUCTION D'EFFICACITE DU BORE OU D'UN AUTRE ABSORBEUR EMPLOYÉ SOUS FORME DE POUDRE DISSEMINE DANS UN PRODUIT NON ABSORBANT, EN FONCTION DE LA GROSSEUR DES GRAINS. (Determination of the Reduction of Efficiency of Boron or of Other Absorbers used in Powder form Disseminated in Non-Absorbant Product, as a Function of the Grain Size.) P. Lafore and J. P. Millot. May 29, 1957. 4p.

Attention has been drawn to the importance of grain size of boron used in powdered form in the fabrication of boral. The calculations determine the efficiency loss of boron as a function of the grain dimensions, assumed to be spherical or ellipsoidal. The grains to be used should not exceed 20 μ in radius. This size corresponds to an efficiency loss of 8%. (J.S.R.)

6592

WHAT'S HAPPENED TO CERMETS? J. W. Graham and W. F. Zimmerman (General Electric Co., Evendale, Ohio). Metal Progr. 73, No. 3, 89-91(1958) Mar.

A brief summary is given of the history of development of cermets. The oxidation, mechanical properties, and impact resistance are reviewed. Possible future applications are discussed. (J.S.R.)

Corrosion

6593 BMI-1252

Battelle Memorial Inst., Columbus, Ohio. THE CORROSION OF TYPE 347 STAINLESS STEEL IN

BOILING DIGEST LIQUORS. Frederick W. Fink, Walter J. Braun, and Oliver M. Stewart. Jan. 28, 1958. 40p. Contract W-7405-eng-92. $1.25(OTS).

Corrosion studies indicate that digest liquors presently in use at the Mallinckrodt Uranium Refining Center should not be excessively corrosive to the digesters, which are constructed of Type 347 stainless steel. Experimental tests have shown that the digest liquors resulting from some of the more recent sources of uranium concentrates might become corrosive if the fluoride, chloride, or free nitric acid contents of these liquors should reach abnormal levels. If such constituents are present, there are corrective procedures that may be employed to prevent excessive corrosion of the stainless steel. It has been demonstrated that aluminum additions to the digest liquors will reduce the attack in both the liquid and vapor phases when relatively high concentrations of fluoride are involved. Iron additions may be used to some extent to combat corrosion arising from high chloride levels. Type 304 ELC stainless steel appears to have comparable corrosion resistance to Type 347 and Carpenter No. 20 stainless. Haynes Alloy No. 25, which showed a somewhat lower rate of penetration tended to form a loose insoluble corrosion product which may be objectionable in service. (auth)

6594 WAPD-NCE-4512

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. SECOND INTERIM REPORT ON THE ZIRCONIUM ALLOY CORROSION PROBLEM. J. G. Goodwin. May 1, 1957. 32p. $6.30(ph OTS); $3.00(mf OTS).

The Zircaloy-3 corrosion problem is associated with white or tan stringers found in the black matrix oxide of Zircaloy-3 samples corrosion tested for 14 days in 750°F steam. The stringers are parallel to the direction of rolling. A similar effect is noted in the cladding of corrosion tested fuel elements manufactured from strip showing this behavior. Because the stringers are noted in the fuel elements and could lead to possible difficulties, an investigation was begun to determine the reasons for the stringers and to determine methods for eliminating them. (auth)

6595

A REACTION RATE STUDY OF THE CORROSION OF LOW-HAFNIUM ZIRCONIUM IN AQUEOUS HYDROFLUORIC ACID SOLUTIONS. Tennyson Smith and George Richard Hill (Univ. of Utah, Salt Lake City). J. Electrochem Soc. 105, 117-21(1958) Mar.

Zirconium dissolves readily in HF solutions leaving a smooth unpitted surface. The rate of dissolution of Zr in aqueous HF solutions has been studied over a temperature range of 7 to 78°C using a radioactive tracer Zr^{95}. The rate was found to be directly proportional to the un-ionized HF concentration. In order to control the equilibrium concentrations of un-ionized HF, HF_2^-, H^+, and F^- ions, most of the solutions contained another component such as HCl, HNO_3, KF, or $HClO_4$. For a given un-ionized HF concentration, the rate was independent of the HF_2^-, H^+, F^-, Cl^-, NO_3^-, K^+, or ClO_4^- concentrations over a wide range. A discussion of the Zr complex ions in solution is given. The gaseous product of the reaction between Zr and aqueous HF with HCl is H_2. When HNO_3 is used in place of HCl the gaseous products are H_2 and N_2O. The diffusion of un-ionized HF from the bulk solution through a diffusion film to the solid surface is postulated as the slow step, the energy of activation being 3.3 kcal/mole. At 25°C the rate constant for the case of rapid stirring is 5.19×10^{-3} g cm^{-2} min^{-1} (moles HF)$^{-1}$ liter. (auth)

6596

MASS TRANSFER IN LIQUID METAL SYSTEMS. 2. ISOTHERMAL TRANSFER. J. W. Taylor (Babcock & Wilcox, Ltd.) and A. G. Ward (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Power 3, 101-5 (1958) Mar.

Isothermal mass transfer is a second type of transfer process in liquid metals, the other being thermal-gradient transfer. In general it involves the transfer of a component from a source via a liquid metal solution to a reaction site usually near a second component, the driving force for the transfer being a free energy change of reaction; the solubility of the transferring in the liquid metal need only be very slight. The form of the reaction product and its location depend upon the phase relationships between the transferring component and the reactant, and between the latter and the liquid metal. The kinetics of the transfer is complex and is influenced by such factors as system geometry, form of reaction product, and source of transferring component. Surface films may seriously influence the transfer in so far as they may affect the source of the transferring component and also the reaction stage. (auth)

6597

ZIRCONIUM AND TITANIUM INHIBIT CORROSION AND MASS TRANSFER OF STEELS BY LIQUID HEAVY METALS. O. F. Kammerer, J. R. Weeks, J. Sadofsky, W. E. Miller, and D. H. Gurinsky (Brookhaven National Lab., Upton, N. Y.). Trans. Met. Soc. AIME 212, No. 1, 20-5 (1958) Feb.

Zirconium and titanium inhibit solution mass transfer of steels by liquid bismuth, mercury, and lead. It is shown that in bismuth and mercury, these adsorb on the surface of the steels and subsequently react with nitrogen and possibly carbon from the steels to form inert, adherent surface layers of ZrN, TiN, or TiN + TiC. Data are presented which describe the condition under which these deposits form. These inhibitors decrease the solution rate of iron into bismuth, and require a higher supersaturation for precipitation of iron from bismuth. (auth)

6598

PROLONGED OXIDATION OF ZIRCONIUM AT 350°C AND 450°C. Robert G. Charles, Sidney Barnartt, and Earl A. Gulbransen (Westinghouse Electric Co., Pittsburgh). Trans. Met. Soc. AIME 212, No. 1, 101(1958) Feb.

Geology and Mineralogy

6599 TEI-82

Geological Survey.

APPLICATION OF GAMMA-RAY LOGS OF OIL WELLS TO THE DISCOVERY OF RADIOACTIVE ORE. Garland B. Gott. Aug. 1949. Changed from OFFICIAL USE ONLY Mar. 11, 1952. 18p. $3.30(ph OTS); $2.40(mf OTS).

A study of 1,000 gamma-ray logs of oil wells in the central part of the U.S. has confirmed the utility of these logs for the detection of radioactive deposits. Radiometric analyses of 200 ft of cores from wells that had been gamma-ray logged indicate that one in. of deflection on a Lane-Wells type of gamma-ray log, made at a sensitivity scale of 10 in., represents approximately 0.0008% equivalent U. In normal sedimentary rocks the radioactivity is generally uniform so long as the lithologic characteristics are uniform; the limestones and sandstones cause the smallest deflections, and the black shales, the greatest. In one area, non-marine arkosic sediments are considerably more radioactive than the marine sediments. A cross-action of one oil field shows a correlation between abnormally high radioactive zones and some overlying He-producing formations. (auth)

6600

THE BLIND RIVER URANIUM FIELD OF CANADA. 2. L. D. Roland (Permutit Co., Ltd.). Atomics and Nuclear Energy 9, 90-3(1958) Mar.

6601
EXPLORING FOR ANCIENT CHANNELS WITH THE REFRACTION SEISMOGRAPH. L. C. Pakiser and R. A. Black (U.S. Geological Survey). Geophysics 22, 32-47(1957) Jan.

In the Monument Valley of Arizona and Utah, uranium ore has been found in ancient channel deposits, primarily in the Shinarump member of the Chinle formation of Late Triassic age. The seismic velocity in the Shinarump member is substantially less than that in the Moenkopi formation of Early and Middle(?) Triassic age, which unconformably underlies the Shinarump. Therefore, the ancient channels can be located by using the refraction seismograph. Because the erosion surface of the Moenkopi in channel areas is curved, a delay-time method of analysis is used to determine the position in depth of the Shinarump and Moenkopi contact. The problem of velocity variations within the Shinarump can be largely overcome by careful interpretation supported by drill-hole and velocity control. (auth)

6602
DISTRIBUTION OF RADIOACTIVITY IN ROCKS AND MINERALS, AND THE EFFECT OF WEATHERING ON DETERMINATIONS OF URANIUM. E. Hamilton (Radiochemical Lab., Mineralogical Museum and Geological Survey of Greenland, Denmark). Nature 181, 697-8(1958) Mar. 8.

Metals and Metallurgy

Refer also to abstracts 7013, 7018, and 7019.

6603 AECU-3636
Michigan. Univ., Ann Arbor.
THERMODYNAMIC PROPERTIES OF NONSTOICHIOMETRIC NICKEL TELLURIDES AND OF TELLURIUM (thesis). Robert E. Machol. 1957. 140p. Contract [AT(11-1)-70]. $21.30(ph OTS); $6.90(mf OTS).

As part of a thermodynamic study of NiTe and $NiTe_2$, an attempt was made to gather data which would determine zero-point entropies as a function of composition. Part of the necessary data have been gathered, and in addition a number of other pertinent or interesting properties of the nickel tellurides, and of Te, have been investigated. Specific heats from 4 to 350°K have been measured on $NiTe_{1.1}$, $NiTe_{1.5}$, and $NiTe_{2.0}$, and the thermodynamic functions of these and all intermediate compositions may be considered accurately known over this temperature range. The method employed was conventional precise adiabatic calorimetry in an existing apparatus. The melting point of Te has been redetermined and the highly discordant literature critically reexamined; the triple point may now be stated with some confidence to be 449.7 ± 0.2°C. The dissociation pressures of compositions from $NiTe_{1.5}$ to $NiTe_{2.0}$ have been accurately measured at temperatures up to 780°C in order to determine the partial molal free energies and entropies of Te in these compounds. These measurements have incidentally elucidated the phase behavior in the Te-rich region, showing a high solubility of Ni in liquid Te at elevated temperatures, and incongruent melting of the solid solutions such that Te-rich solid solutions are unstable at elevated temperatures. By extrapolation, the boiling point of Te is computed to be 993.6 ± 2°C, and the heat of vaporization to be 33,850 − 908 t cal/mole (one mole equals two gram-atoms), with an accuracy of plus or minus several hundred calories, from the triple point to t = 850°, or perhaps 950°C. This figure may be considered more accurate, though stated with less precision, than those of previous investigators. (auth)

6604 AERE-M/R-2242
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE PREPARATION, PROPERTIES AND ALLOYING BEHAVIOUR OF THORIUM. J. R. Murray. 1958. Date of MS. June 25, 1952. Decl. with amendment Jan. 30, 1957. 38p. $0.99(BIS).

The methods of preparation, physical properties, and alloying behavior of thorium are reviewed, the information being drawn from the literature and from some unpublished results obtained at A.E.R.E. (auth)

6605 ANL-5628
Argonne National Lab., Lemont, Ill.
ROLL CLADDING URANIUM–ZIRCONIUM AND URANIUM–ZIRCONIUM–NIOBIUM ALLOYS WITH ZIRCALOY-2 FOR PLATE-TYPE FUEL ELEMENTS. C. H. Bean, R. E. Macherey, and J. R. Lindgren. Feb. 1958. 288p. Contract W-31-109-eng-38. $6.00(OTS).

Clad plate-type fuel elements containing U–5 wt. % Zr–1.5 wt. % Nb alloy cores integrally clad on all surfaces with Zircaloy-2 were developed for the Experimental Boiling Water Reactor (EBWR). These plates were prepared by roll bonding assembled components inside steel jackets at 850°C with 80% reduction in thickness to effect sound diffusion bonds at all component surfaces. To obtain reproducible sound bonds, uranium alloy core and cladding components were clean and free from surface contamination, such as inclusions, oxides, or other foreign material; contamination of mating surfaces was avoided during welding operations; all bonding surfaces were sealed to prevent contamination from outgassing of the steel jacket during heating and rolling; billets were designed with a differential thermal expansion allowance for the core relative to the cladding; and all assembled billet components were evacuated and sealed by welding in vacuum. Integrally roll-bonded end closures were obtained by orienting billet end plugs so that the prior hot-working anisotropy of Zircaloy-2 would increase their lateral spread and facilitate the Zircaloy-2 end to Zircaloy-2 side bonds during rolling. Investigations were made of alternate methods of bonding fuel shapes and the use of alternate core alloys in flat plates. Roll bonding in shaped pass rolls, cast bonding the core alloy into Zircaloy-2 molds, and bonding by coextrusion were all found to be feasible, although no integrally clad specimens were prepared for in-pile testing. Substitution of U-Zr binary alloys for the ternary reference alloy in roll-clad plates did not appear promising from corrosion test data, and further development with core alloy substitutions was abandoned. Alterations and additions were made to development facilities needed to fabricate roll-clad plates for the EBWR core. Pilot production of EBWR-type plates proved that the plate cladding process could be adapted to production facilities. (auth)

6606 CEA-694
France. Commissariat à l'Énergie Atomique, Paris.
SUR L'AFFINAGE DU GRAIN DE L'URANIUM. (On the Improvement of the Grain of Uranium). J. Beroujon, M. Englander, J. A. Stohr, and A. Winogradsky. June 27, 1957. 21p.

Thermal and mechanical treatments were used on uranium wires in an attempt to improve the grain of uranium. The results showed that if the geometric dimensions of the uranium could not be modified, some improvement could be obtained by variations of the microstructure during allotropic transformations. However, without previous mechanical treatment, the thermal treatment led only to a

strongly irregular and limited improvement. If the geometric dimensions of the uranium were modified, a great improvement was obtained by recrystallization before cold working. A homogeneous microstructure composed of equiaxial grains of an average diameter of 15 μ was obtained by heating the uranium for 1 hour between 500 and 550°C, the reduction rate being between 20 and 50%. This treatment, applied to bars with approximately the same diameter as that of bars used in the pile, and with cold working with a rotating hammer led to a very satisfactory improvement of the grain. (J.S.R.)

6607 HW-53486

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

U–Ni, Ni–Al, AND U–Al DIFFUSION: A SURVEY OF THE LITERATURE. D. R. Green. Aug. 17, 1957. Decl. Feb. 25, 1958. 16p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

The diffusion rates in metal–metal couples of U–Ni, Ni–Al, and U–Al are presented. (W.L.H.)

6608 KAPL-M-ABR-3

Knolls Atomic Power Lab., Schenectady, N. Y.

COMPARISON OF 680°F WATER AND 750°F STEAM AS AN ACCEPTANCE TEST FOR ZIRCALOY. A. B. Riedinger. Feb. 1958. 14p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

From these results it is indicated that a statistically significant correlation can be obtained from the results of three-day, 750°F steam and fourteen-day, 680°F water tests. The results of these two tests show sufficient differences so that they cannot be considered interchangeable. Short-term tests, such as one, three, or fourteen days in 750°F steam or fourteen days or less in 680°F water can only be expected to detect gross variation in corrosion resistance. (auth)

6609 KAPL-M-KOK-6

Knolls Atomic Power Lab., Schenectady, N. Y.

LOW-COBALT HARD FACING ALLOYS. K. H. Koopman. Feb. 18, 1958. 8p. Contract W-31-109-Eng-52. $1.80 (ph OTS); $1.80(mf OTS).

A survey was made to develop sources for wear and corrosion-resistant hard facing rods and electrodes that are low in Co and which have a possibility of giving good performance in pressurized hot water up to 650°F. (W.L.H.)

6610 MAB-122-M

National Research Council. Materials Advisory Board.

RESULTS OF TESTS EVALUATING COMPRESSION TESTING TECHNIQUES OF SHEET MATERIALS AT ELEVATED TEMPERATURES. Mar. 7, 1958. 20p. Contract DA-36-039-ac-76436.

The compression jigs reported utilizing solid, opposed, or offset groove guides as well as the ball bearing type guides appear to result in satisfactory performance as viewed from the standpoint of friction. With the use of a satisfactory compression jig, the over-all strain measuring systems with an accuracy of less than ± 2% were able to obtain average values of E within ± 5% of the reference values in practically all cases. On the basis of reproducibility over the complete temperature range and the small deviation of the average E values from the reference values, the compression test technique appears to be superior to the others evaluated in this program. (auth)

6611 NP-6611

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

THE CHEMICAL MILLING OF TITANIUM. Walter K. Boyd. Jan. 17, 1958. 11p.

The chemical milling process for Ti and its alloys is described, and its applications and its technological advantages are discussed. (J.E.D.)

6612 NYO-8528

Penn-Texas Corp., New York.

PRELIMINARY REPORT ON THE METAL POWDER SLIP CASTING PROCESS. PART I. Henry H. Hausner, Donald P. Ferriss, Edmund B. Wilson, and Frank W. Heck. Sept. 9, 1957. 23p. Contract AT(30-1)-1991.

It has been shown that slip casting of stainless steel powder is a process which results in a highly dense sintered material. The slip casting process is described in detail and the raw materials, such as metal powders, deflocculants, etc., are discussed. It has been observed that the viscosity of the slip is not of prime importance in the process, but rather its pH value. The effect of the variables in the process on the density of the material in various stages of the process has been investigated. Careful selection of raw materials and the processing steps permit fabrication of slip castings of high "green" strength which can be easily handled without any danger of breakage even before sintering. Photomicrographs show the uniformity of grain structure of slip cast stainless steel. (auth)

6613 ORNL-2351

Oak Ridge National Lab., Tenn.

THE APPLICATION OF A NOMINAL 48 WT % U–Al ALLOY TO PLATE-TYPE ALUMINUM RESEARCH REACTOR FUEL ELEMENTS. W. C. Thurber, J. H. Erwin, and R. J. Beaver. Mar. 11, 1958. 35p. Contract W-7405-eng-26. $1.25(OTS).

Under the Atoms-For-Peace Plan, the specification that uranium be limited to 20% enrichment in the U^{235} isotope has necessitated development of a highly-concentrated uranium–aluminum alloy as the fuel material in the composite aluminum plates of research reactor fuel elements. Efforts have been directed to determining the suitability of a nominal 48 wt. % U–Al alloy in relation to previously established procedures for manufacturing plate-type aluminum fuel elements. Increasing the uranium concentration from 18 wt. % to the 48 wt. % resulted in increased segregation, higher strength, and loss of ductility, creating additional fabrication difficulties. Nonuniform deformation of the alloy during roll bonding into composite plates caused localized thinning of the cladding, which may limit the material to specific reactor applications. Substitution of Type 6061 aluminum for Type 1100 aluminum as frame and cladding of the fuel plates improves this condition. A fuel element, containing the 48 wt. % U–Al alloy, was irradiated in the active lattice of the MTR to an estimated burnup of 25% of the U^{235} atoms with no observable damage. (auth)

6614 USNRDL-TR-177

Naval Radiological Defense Lab., San Francisco.

THERMAL DIFFUSIVITY OF METALS AT ELEVATED TEMPERATURES. Summary Status Report. C. P. Butler and E. C. Y. Inn. Sept. 20, 1957. 44p.

A brief analysis of the heat conduction boundary value problem is presented in which an infinite, insulated slab is irradiated on one side with an intense source of thermal radiation from a carbon arc. From the solution of this problem a rapid method of measuring the thermal diffusivity of solid materials at elevated temperatures has been developed. Thermal diffusivities of 9 metals have been measured over temperature ranges from ambient to near the melting point. Advantages, limitations and errors of the experimental procedures are discussed. It has been found that for certain metals the thermal diffusivity is a

function of not only the temperature but also the prior thermal history of the metal. (auth)

6615 WADC-TR-57-709
Carnegie Inst. of Tech., Pittsburgh.
TRANSFORMATION MECHANISMS IN HYPOEUTECTOID AND HYPEREUTECTOID TITANIUM–CHROMIUM ALLOYS. Period covered: January 1, 1957 through December 31, 1957. Hubert I. Aaronson, George M. Andes, Walter B. Triplett, Lawrence S. Redmerski, and Cyril Wells. Dec. 1957. 25p. Project title: SOLID STATE RESEARCH AND PROPERTIES OF MATTER. Task title: PHASE RELATIONSHIPS IN METALLIC AND CERAMIC SYSTEMS. Contract AF33(616)-3969. (AD-142175).

A detailed morphological study has been made of the proeutectoid $TiCr_2$ and eutectoid reactions in a sponge-base Ti–17.42% Cr alloy isothermally transformed at temperatures from 775 through 550°C. The morphologies of proeutectoid $TiCr_2$ were shown to be subject to description by the Dube morphological classification system. Grain-boundary allotriomorphs are the dominant proeutectoid morphology throughout the temperature range investigated. Intragranular plates, and especially Widmanstatten side-plates, form only in small numbers. Idiomorphs were found, also in limited numbers, both intragranularly and at the grain boundaries. This morphological pattern differs markedly from that of the proeutectoid alpha reaction, as previously observed in hypoeutectoid Ti–Cr alloys, in which plates form prolifically throughout wide temperature ranges. The eutectoid reaction is non-lamellar in character at 675°C. An increasingly prominent pearlitic component develops at lower temperatures. Both eutectoid alpha and eutectoid $TiCr_2$ precipitate largely, if not entirely, from beta. The morphologies of proeutectoid alpha were studied in an iodide Ti–10.8% Cr alloy and were found to be essentially the same as those formed at temperatures 50 to 75°C higher in an iodide Ti–7.22% Cr alloy. This difference corresponds roughly to the 50°C difference in the transus temperatures of the two alloys. The eutectoid reaction in the Ti–10.8% Cr alloy was found to be entirely of the non-lamellar type. The beta phase was completely decomposed to proeutectoid alpha and eutectoid structure in the temperature range 625°C through 550°C, providing good evidence that the eutectoid temperature of the titanium–chromium system lies at a higher temperature, rather than in the vicinity of 500°C. (auth)

6616 WAL-401/65-40
Carnegie Inst. of Tech., Pittsburgh.
RESEARCH AND DEVELOPMENT ON DETERMINATION OF COEFFICIENTS OF FRICTION BETWEEN DRY METALLIC SURFACES. Final Report. Eber W. Gaylord and Hunter Shu. Oct. 31, 1957. 51p. DA Project No. 5A12-15-003. Contract DA-36-061-505-ORD-545.

Coefficients of static friction were determined for mild steel rubbing on mild steel, Ti RC 130B on mild steel, Ti RC 130-B rubbing on U, U rubbing on U, Be rubbing on U and Be rubbing on Ti for both statically and dynamically applied loads. Normal rubbing pressures range between 1500 and 12,000 psi for statically applied loads and between 12,000 psi and 21,000 psi for dynamically applied loads. Coefficients of kinetic friction have been determined between various metals for rubbing speeds between 30 and 50 fps and rubbing pressures of 1600 to 3,000 psi. (auth)

6617 WAPD-PWR-PMM-699
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]
OUTLINE OF PWR ALTERNATE CONTROL MATERIAL INFORMATION OBTAINED AT BETTIS. Mar. 15, 1957. 36p. $6.30(ph OTS); $3.00(mf OTS).

The fabrication of silver-base alloy control rod materials is described. Corrosion test data are given for silver-base alloys in various media. (W.L.H.)

6618 WASH-181(Del.)
Division of Reactor Development, AEC.
ATOMIC ENERGY COMMISSION WELDING CONFERENCE. MINUTES—AEC WELDING COMMITTEE MEETING, ARGONNE NATIONAL LABORATORY, NOVEMBER 9 AND 10, 1953. Sept. 30, 1954. Decl. with deletions Mar. 10, 1957. 372p. $55.80(ph OTS); $11.10(mf OTS).

The principal problems discussed concerned the inert arc welding of stainless steel in which N_2 was used as a purging gas, the corrosion of welds, and the properties of brazing alloys used in the fabrication of metallic plate type fuel elements. (J.E.D.)

6619 AEC-tr-2838
PROTECTIVE COATINGS FOR HIGH-MELTING METALS. R. Kieffer and E. Nachtigall. Translated from Métaux (Corrosion-Ind.) 27, 312-17(195[2]). 20p.

High-melting metals (molybdenum, tungsten, tantalum, and niobium) exhibit, at high temperatures, mechanical properties that are very interesting for various high-temperature uses, such as in combustion motors and in turbines. Unfortunately, these metals are easily oxidized in air at temperatures exceeding about 400°C. To protect their surface and to make possible their utilization at very high temperatures, a large number of processes have been proposed, involving the coating of the metal surfaces with a dense and refractory protective layer. After the old coating methods with a ceramic substance or a fused oxide, the more recent research activities are centered around either the deposition of a hard compound (silicide, boride, carbide) from a gaseous phase, or on the formation of an adherent metallic layer which is subsequently converted into a dense oxide film. The process of forming a silicide coating by reacting a gas with the metal, and the coating process with a refractory silicate formed by the oxidation of a suitable alloy layer are studied. (auth)

6620 AEC-tr-2924
FOURTH SYMPOSIUM [ON] PROBLEMS OF METALLOGRAPHY AND THE PHYSICS OF METALS. (Problemy Metallovedeniya i Fisiki Metallov Chetvertyi Sbornik Trudov.) B. Ya. Lyubov, ed. Translated from a publication of the State Scientific Technical Press, Moscow, 1955. 670p.

Papers presented at the symposium include the following: theory and computations for the introduction of elastic oscillations into molten metals; effect of low-frequency vibrations in the mold on ingot crystallization; x-ray investigation of cokes and coals; vacuum alloys; effects of intermolecular interaction on the behavior of solutions; mechanism of the influence of Al on the secondary austenite grain in steel; form dependence on crystal growth on speed of growth; microstructural investigation of martensitic transformation; effect of deformation on the speed of the isothermal martensitic transformation in Fe–Ni–Mn alloy; changes in the fine structure of austenite and of the kinetics of the martensitic transformation under the influence of plastic deformation; effect of cooling conditions on the kinetics of the martensitic transformation; the effect of hot plastic deformation on the kinetics of the martensitic transformation in high-nickel steels; the nature of the change of the coercive force upon annealing of hardened low-carbon steel; phenomenon of stabilization in reverse martensitic transformation; the change of coercive force in low-temperature tempering; the coercive force and the width of the x-ray interference line in low-

carbon alloyed steels; the processes of carbide formation in isothermal decomposition of alloyed austenite; effects of elements forming difficulty soluble carbides, on the decomposition of austenite; phase analysis of alloys using the radioactive tracer method; investigation of the distribution of Cr and W during the decomposition of austenite, using the radioactive tracer method; solubility limit of certain alloying admixtures in steel; new type of preparation for electron-microscopic investigation of dispersed structures of two-phase alloys; thermodynamic activity of carbon in austenite containing Mn and Si; the nature of the hardness of tempered steel; x-ray analysis of deformations and binding forces in the crystal lattice of metals and alloys; variation of the kinetics of weakening with the composition of the strengthening phase during dispersional hardening; energy of a deformed crystalline lattice; thermodynamics of crystal lattices with vacancies; x-ray determination of the characteristic temperature of Cr, Ni, and Mo; x-ray investigation of interatomic reactions in solid solutions with a Ni base; effect of Cr on the binding forces in α-Fe crystals; binding forces and statistical deformations in the lattice of alloyed steel; effect of alloying admixtures on the temperature dependence of shear modulus of iron; investigation of the variation of intensity of x-ray interference lines of deformed steel; determination of vapor tension of solid cobalt in iron using radioactive isotopes; determination of binding energy in austenite lattices; influence of carbon on the binding forces and on the static distortions in martensite crystals; x-ray analysis of the carbide phase of patented steel wire; the diffusion of Co, Cr, and W in Fe and Steel; the problem of studying diffusion by the method of radioactive isotopes; influence of intra-grain structure of austenite on the self-diffusion of Fe; influence of carbon on the self-diffusion of Fe in the system Fe-Ni; influence of Mn on the self-diffusion of Fe; influence of alloying on the self-diffusion of Co; influence of Cr on the self-diffusion of Fe; a study of the self-diffusion of α-Fe; theory of methods for determining concentration dependences of diffusion coefficients in solid solutions; influence of oxides of alkaline earth metals on the distribution of sulfur between Fe and Fe slag; distribution of sulfur and phosphorus between Fe and acid slag; an investigation of the desulfurization of cast iron by soda; a new method for studying equilibria in the system metal-slag; the plastic properties of modified steel Kh 25 N 20; the radiation of an x-ray tube fed with alternating current; measurement of the level of a liquid metal by means of γ-rays; and use of compensators to improve the distinguishability of defects in the photographic method of γ-ray flow inspection. (W.L.H.)

6621 AEC-tr-3167

CONDITIONS FOR THE DEPOSITION AND STRUCTURE OF COMPACT ELECTROLYTIC METAL DEPOSITS. PART II. ELECTROLYTIC NICKEL DEPOSITS IN THE RANGE OF THE FT AND UD TYPE. J. Elze. Translated by K. S. Bevis from Metall 9, 104-9(1955). 15p.

In the deposition of nickel from one of the electrolytes its base character and the relatively small hydrogen overvoltage on nickel causes hydrogen as well as the metal to be continuously discharged from the bath. The hydroxyl ions concentrated in the vicinity of the cathode surface and the atomic and molecular hydrogen evolved during the deposition process can influence both the precipitation mechanism and even the properties of the precipitated metal. Added to this is the fact that the inhibitor sensitivity of nickel is greater than that of copper, and accordingly the deposition of nickel, for example, is effected more strongly when foreign substances are added to the electrolyte. While copper is classed as an "intermediate" metal, nickel is an "inactive" metal which indicates a relatively high metal overpotential. (auth)

6622 AEC-tr-3176

NEW METHOD OF DEOXIDATION AND DESULFURIZATION OF STEEL WITH IMPROVEMENT IN ITS QUALITY. V. A. Skachko and N. P. Merenkov. Translated by Michael Roman from Stal' 17, 521-2(1957). 8p.

The experimental smelting process has confirmed the effectiveness of the new method of deoxidation of metal by aluminum with the use of so-called deoxidizing tubes. The carbon steel deoxidized by this method can be recommended to replace the unalloyed steels, if the stability of the metal against corrosion is of no significance. (auth)

6623 NACA-TM-1411

STUDY OF THE MICRO-NONUNIFORMITY OF THE PLASTIC DEFORMATION OF STEEL. (Issledovanie Mikroneodmorod-nosti Plasticheskoi Deformatsii Stali). B. B. Chechulin. Translated by Mary L. Mahler from Fiz. Metal. i Metalloved. Akad. Nauk S.S.S.R., Ural'. Filial 1, 251-60(1955). 21p.

In 1949 Pashkov showed experimentally the enormous variation in strain from point to point in a polycrystalline metal. These large deviations from the mean strain are believed to have important effects upon the strength and flow characteristics of a metal. This work is continued in the present paper, in which the author presents a new statistical method for the study of nonuniform strains. By means of frequency diagrams of the axial inequality of the grains of a polycrystalline metal before and after loading, the average deviation of the strain from the mean can be determined. By this method it is shown that steel with an austenitic structure undergoes strains which differ much less from the mean than steels with ferritic or pearlitic structure. In the latter case, the deviations from the mean increase continuously with the mean strain. (auth)

6624

DETERMINATION OF DIFFUSION COEFFICIENTS WITHIN THE VOLUME AND AT THE BOUNDARIES OF METAL GRAINS. V. T. Borisov, V. M. Golikov, and B. Ya. Lyubov. Translated by P. Collins from Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, No. 10, 37-47(1956).

The theoretical basis and an experimental application of the absorption method, which allows D and D_1—the coefficients of volumetric and boundary diffusion—to be determined by the change of the integral activity of the specimen during the process of diffusion are described. (W.L.H.)

6625

FACTORS AFFECTING THE ALPHA-BETA PHASE BOUNDARIES OF ZIRCONIUM AND TITANIUM ALLOYS. J. O. Betterton, Jr. and J. H. Frye, Jr. (Oak Ridge National Lab., Tenn.). Acta Met. 6, 205-11(1958) Mar.

The variation of the phase boundaries, arising from the allotropic transition in zirconium and titanium, can be reduced to an approximate common behavior in terms of electron concentration if a metallic valency of 2 is used for zirconium and titanium, and if allowance is made for energy effects due to unequal sizes of atoms. Thermodynamic relations are given for these phase boundaries which with certain approximations permit the boundaries to be used to derive the relative changes of energy in the two phases with alloy composition. (auth)

6626

ON REFINING OF ZIRCONIUM BY THE IODIDE METHOD. G. I. Stepanova and F. I. Busol. Atomnaya Energiya 3, No. 10, 344-6(1957).

A new explanation of the dependence of the zirconium flux on the pressure of the tetraiodides, which are used

for the purpose of purification of zirconium, is theoretically derived. (TCO)

6627

INVESTIGATIONS OF THE METALLIC COMPOUND FORMED IN IRON–TITANIUM ALLOYS. R. B. Golubtsova (Baikov Inst. of Metallurgy). Doklady Akad. Nauk S.S.S.R. 118, 89-91(1958) Jan. 1. (In Russian)

6628

X-RAY STUDY OF FAULTS IN BODY-CENTERED CUBIC METALS. O. J. Guentert and B. E. Warren (Massachusetts Inst. of Tech., Cambridge). J. Appl. Phys. 29, 40-8(1958) Jan.

The effect on the x-ray-diffraction pattern of deformation faults and twin faults occurring at random on the (211) planes of a b.c.c. lattice has been investigated. In single crystal reflections, deformation faults produce peak shifts and peak broadening, and twin faults produce a peak asymmetry and peak broadening. For a powder pattern it is necessary to average over the different components of a powder-pattern peak; the peak shifts average out to zero, and the peak asymmetries to a quantity which is generally too small to measure. Both types of fault produce a line broadening which varies strongly from one powder peak to another. The hkl dependence of the broadening is the same for the two kinds of faults, and only a combination of the two probabilities can be measured. Measurements were made on samples of cold-worked β-brass filings in different states of annealing. There were no measurable peak shifts or peak asymmetries. The ratios of the effective particle size values could be explained only if a major part of the particle size broadening is due to faulting. The results are discussed in connection with measurements on other cold-worked b.c.c. metals. (auth)

6629

ANODIC POLARIZATION OF TITANIUM IN NONAQUEOUS BASE ETCHING SOLUTIONS. Morris Eisenberg and Robert E. DeLaRue (Stanford Research Inst., Menlo Park, Calif.). J. Electrochem. Soc. 105, 162-9(1958) Mar.

Results of systematic studies of the anodic polarization of titanium in essentially nonaqueous electrolytic etching baths of hydrogen fluoride are described. Solvents included ethylene glycol, dioxane, and tetrahydrofuran. A direct method using nickel reference electrodes was employed. The studies covered a current density range from 0 to 100 ma/cm^2 at temperatures ranging from 25 to 65°C. Plots of current density vs. net anode polarization show an interesting rapid rise of the polarization (by an incremental change ranging from 1.3 to 4.1 v) at a "critical" current density whose value depends on bath composition and temperature. The critical current density, which varied from 6.5 to 15 ma/cm^2 (when working with ascending current densities), has been found, in the course of experiments designed to test the applicability of Faraday's law, to correspond to a point at which chemical (local action) attack by the hydrofluoric acid is essentially eliminated and the linear rate of anode dissolution corresponds to the requirements of Faraday's law. For a completely nonaqueous solution (including both HF and H_2SO_4) a cathodic polarization curve was also determined. A linear relationship between the polarization and the current density was found and interpreted to be due both to the dissolution of the titanium cathode and to the hydrogen discharge process. For each of the six solutions studied, the parameter L/k (dE/dI) was evaluated and compared with the observed nonuniformity of the etching as manifested by electropolishing in areas of high current density. This parameter was found to be a valuable criterion of the uniformity of current distribution only within the range of conditions at which a desirable anodic process can take place. Anodic polarization and dissolution rate studies offer a valuable method for determination of the optimum conditions for anodic etching of titanium without causing hydrogen embrittlement. (auth)

6630

POWDER METALLURGY IN THE USSR. Claus G. Goetzel (New York Univ., N. Y.). J. Metals 10, 180-1(1958) Mar.

Information gathered by a metallurgical exchange team in Russia is summarized. Research and development on the powder metallurgy of titanium, beryllium, and intermetallics and cermets are briefly discussed. (J.S.R.)

6631

IMPROVEMENT IN HIGH-TEMPERATURE ALLOYS BY BORON AND ZIRCONIUM. W. J. Pennington (Universal-Cyclops Steel Corp., Bridgeville, Penna.). Metal Progr. 73, No. 3, 82-6(1958) Mar.

The effects of small additions of boron and zirconium on the high-temperature rupture and elongation behavior of various nickel-base and cobalt-base alloys and one iron-base alloy are investigated. Small additions of boron and zirconium to the vacuum-melted nickel-base and cobalt-base alloys improved the ductility and rupture life. Small boron additions to air-melted iron-base alloys greatly improved the notched-bar rupture strength. (J.S.R.)

6632

DESCALING OF TITANIUM. W. B. Stephenson, Jr. (General Electric Co., Cincinnati, Ohio). Metal Progr. 73, No. 3, 87-9(1958) Mar.

The formation of an oxide film on titanium during heat treatments often hampered subsequent welding or cold forming operations. A hot solution of sulfuric acid and calcium fluoride converts the scale to a gray film which can be readily removed by short immersions in a hot mineral acid bath, preferably a combination of 10% nitric acid with 2% hydrofluoric acid. The resulting surface is bright and smooth. This two-solution descaling method does not affect the welding and shaping characteristics of the metal. (J.S.R.)

6633

ZIRCONIUM AND ITS ALLOYS. C. Tyzack (U. K. Atomic Energy Authority, Industrial Group, Culcheth, Eng.). Nuclear Eng. 3, No. 24, 102-14(1958) Mar.

A summary is presented of the metallurgical, physical, chemical, and nuclear data on Zr, together with a brief discussion on the effects of irradiation and applications of the metal outside the nuclear industry. 73 references. (auth)

6634

SOLUBILITY OF NICKEL AND CHROMIUM IN MOLTEN LEAD. T. Alden, D. A. Stevenson, and J. Wulff (Massachusetts Inst. of Tech., Cambridge). Trans. Met. Soc. AIME 212, No. 1, 15-17(1958) Feb.

A portion of the liquidus curve has been determined for the binary alloy systems Ni–Pb and Cr–Pb. The solubility of nickel is 0.53 at. % at 372° and 18.63 at. % at 1200°C. Chromium shows low solubility, 0.634 at. % at 1210°C. Molybdenum and tungsten were also studied and found insoluble in lead, less than 0.005 at. % at 1200°C. (auth)

6635

DELTA PHASE FIELD OF THE U–Zr EQUILIBRIUM DIAGRAM. J. F. Duffey and C. A. Bruch (Knolls Atomic Power Lab., Schenectady, N. Y.). Trans. Met. Soc. AIME 212, No. 1, 17-19(1958) Feb.

On the basis of metallographic and cooling-rate studies of 15 U–Zr alloys, a new version of the δ phase region of the U–Zr phase diagram is proposed. (auth)

6636

EFFECT OF HYDROGEN ON THE FATIGUE PROPERTIES OF TITANIUM AND Ti–8 Pct Mn ALLOY. L. W. Berger,

W. S. Hyler, and R. I. Jaffee (Battelle Memorial Inst., Columbus, Ohio). Trans. Met. Soc. AIME 212, No. 1, 41-5(1958) Feb.

Hydrogen additions of 390 ppm to A-55 titanium and 368 ppm to Ti-8 pct Mn have no deleterious effect on the unnotched and notched rotating-beam fatigue properties of these materials. These amounts of hydrogen, however, are sufficient to cause severe notch-impact embrittlement in A-55 titanium and pronounced loss of tensile ductility in Ti-8 pct Mn. The lack of embrittling effect in fatigue in the latter alloy is consistent with the postulated strain-aging mechanism of hydrogen embrittlement in α-β alloys. There is a significant increase in the unnotched endurance limit of A-55 titanium with the addition of hydrogen. This increase may be explained as the result of internal heating effects which would dissolve the hydride and cause solid-solution strengthening. (auth)

6637

ANOMALOUS BEHAVIOR DURING COLD WORKING AND SUBSEQUENT HEATING OF CERTAIN MAGNESIUM BASE ALLOYS. J. C. McDonald (Dow Chemical Co., Midland, Mich.). Trans. Met. Soc. AIME 212 No. 1, 45-6(1958) Feb.

Certain Mg-base alloys when cold rolled harden until they break up in the rolls at a 30 to 50% reduction. When heated after rolling to full hardness, they soften. Other Mg-base alloys have shown themselves capable of being cold rolled indefinitely, provided the ratio of roll diameter to starting gage is sufficiently high. (W.L.H.)

6638

A PSEUDO-BINARY IN THE U-Cb-C SYSTEM. R. B. Roof, Jr. (Los Alamos Scientific Lab., N. Mex.). and J. J. Lombardo (Universal Cyclops Steel, Bridgeville, Penna.). Trans. Met. Soc. AIME 212, No. 1, 50-1(1958) Feb.

During the course of investigations on U-Nb alloys an impurity was observed in several different alloys of various compositions. The impurity was metallographically identified as a carbide by its shape, quantity, and reaction with HNO_3 etchant. The metallographic results strongly support the x-ray-diffraction evidence that the unknown face-centered-cubic phase is a monocarbide of U and Nb. (W.L.H.)

6639

TITANIUM-RICH CORNER OF THE Ti-Al-Si SYSTEM. F. A. Crossley and D. H. Turner (Illinois Inst. of Tech., Chicago). Trans. Met. Soc. AIME 212, No. 1, 60-3(1958) Feb.

The titanium-rich corner of the system Ti-Al-Si has been studied to determine the phase relationships in the temperature interval 600 to 1200°C. Metallographic examination of long time isothermally annealed specimens was the means of investigation. (auth)

6640

EFFECT OF COMPOSITION AND HEAT-TREATMENT ON THE UNIFORM ELONGATION AND FLOW PROPERTIES OF ALPHA-BETA TITANIUM ALLOYS. A. J. Griest, H. A. Robinson, and P. D. Frost (Battelle Memorial Inst., Columbus, Ohio). Trans. Met. Soc. AIME 212, No. 1, 117-21(1958) Feb.

The flow characteristics and uniform elongation of alpha-beta titanium alloys in the solution-treated condition were shown to be markedly affected by the solution temperature. Two classes of alpha-beta alloys were distinguished, based on the effect of solution temperature on the uniform elongation. Martensitic alpha-beta alloys, which are relatively weakly beta-stabilized, showed decreasing values of uniform elongation as the solution temperature was initially increased. However, after solution-treatment at still higher temperatures in the alpha-beta field, the uniform elongation of these alloys was again high, and often attained its maximum value. Nonmartensitic alpha-beta alloys, which are more heavily beta-stabilized, showed a continuous decrease of uniform elongation with increasing solution temperature. The behavior was rationalized in terms of the alpha-beta ratio and the alloy content of the beta existing at the solution temperature. The data indicate that in commercial practice close temperature control may be required to get maximum uniform elongation, and hence, maximum potential formability, in solution-treated sheet. Bend-test data also were obtained for the solution-treated conditions. (auth)

PHYSICS

Refer also to abstracts 6987, 7029, 7031, 7032, 7036, 7037, 7038, 7039, 7041, 7042, 7044, 7045, and 7047.

6641 K-1182

Carbide and Carbon Chemicals Co. K-25 Plant, Oak Ridge, Tenn.

THE TRANSITION FROM LOCALIZED TO MOBILE ADSORPTION. W. C. DeMarcus and J. N. Dyer. Dec. 1, 1954. 26p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

The mobility of an isolated atom adsorbed on a crystalline surface is investigated using the laws of quantum mechanics. The results are in essential agreement with the customary rate equations when the particles are heavy or the potential barriers on the surface are high. The thermal properties of an adsorbed phase are also deduced on the assumption of low surface coverage. It is found that the specific heat curve is not a good indicator of mobility. (auth)

6642 NP-6600

Johns Hopkins Univ., Baltimore.

A SURVEY OF ATOMIC CONSTANTS. J. A. Bearden and John S. Thomsen. [1955?]. 146p. Contract Nord 11299.

Recent adjustments of the atomic constants show a serious discrepancy between the adjusted value of λ_g/λ_s (the conversion factor from the Siegbahn x-ray scale to absolute units) and the accepted average of the direct experimental results by ruled grating measurements. As an attempt to resolve this discrepancy, a general survey of the atomic constants was made. Much information which is chiefly of historical interest was included. An attempt is made to reevaluate errors wherever this appeared necessary and to choose the most reliable experiments for inclusion in the present adjustment. (auth)

6643 ORNL-2467

Tennessee. Univ., Knoxville.

THERMOCOUPLE RESEARCH REPORT FOR THE PERIOD NOVEMBER 1, 1956 TO OCTOBER 31, 1957. Progress Report No. 1. David L. McElroy. Mar. 5, 1958. 97p. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract 1072. $2.75(OTS).

The general characteristics of thermocouples are reviewed, and particular reference is made to available information on the chromel-alumel type alloys. A description of the experimental equipment constructed and operated for thermocouple calibration, time-at-temperature studies of changes in thermal emf, and heat treating of wires is presented. (W.L.H.)

6644 RFP-82

Dow Chemical Co. Rocky Flats Plant, Denver.

IN SITU NEUTRON MULTIPLICATION MEASUREMENTS AS AN AID IN MAKING CRITICALITY RECOMMENDA-

TIONS C. L. Schuske. Sept. 18, 1957. 6p. Contract AT(29-1)-1106. $1.80(ph OTS); $1.80(mf OTS).

The techniques used for in situ criticality studies are generalized. Some of the advantages and disadvantages are listed. (J.S.R.)

6645 AEC-tr-2892

MODERN PROBLEMS OF THE THEORY OF PLASTICITY. A. A. Il'iushin. Translated from Vestnik Moskov. Univ. 10, 101-13(1955). 20p.

6646

CONTROLLED FUSION RESEARCH IN FRANCE. P. Hubert (Commissariat à l'Energie Atomique, Saclay, France). Atomics and Nuclear Energy 9, 86-8(1958) Mar.

French workers have attained temperatures of well over one million degrees in a toroidal discharge, and results are reported. (J.E.D.)

6647

NUCLEAR FUSION IN GERMANY. L. Biermann (Max-Planck-Institut für Physik, Göttingen, Germany). Atomics and Nuclear Energy 9, 89(1958) Mar.

6648

VACUUM SETUP FOR INVESTIGATION OF THE TRUE SPECIFIC HEAT OF METALS AT HIGH TEMPERATURES. A. I. Lazarev and B. N. Dun'kov. p. 5-20 in Issledovaniya v obl. Teplovykh Izmereniy. Moscow and Leningrad, Mashgiz, 1956. (Translated from Referat. Zhur. Fiz. No. 2, 1957, Abstract No. 3487).

Description is given of a setup for the measurement of the true specific heat C_p of metals for temperatures up to approximately 1000 to 1100°. The method is based on the investigation of the heat balance between two specimens of identical shape (one of which is provided with a heater), located in a copper block. The method is an extension of the already described method (Referat. Zh. Fizika, 1956, 25291). The measurement limits are extended by using the vacuum apparatus. The values of C_p were measured for eutectoid steel. The C_p vs. T curve displays anomalies corresponding to the Curie point of cementite, to the magnetic $\alpha \rightarrow \beta$ transformation, and to the eutectoid transformation, to which the break in the continuity of the curve corresponds.

6649

THE BASIC CONCEPTS OF MAGNETO-HYDRODYNAMICS. S. B. Pikel'ner. Izvest. Akad. Nauk S.S S.R. Otdel. Geofiz., No. 1, 47-53(1958) Jan. (In Russian)

A short account is given of the basic principles of magneto-hydrodynamics. Effects of propagation of media on the magnetic field and the action of the field on the media are discussed. (R.V.J.)

6650

PRODUCTION OF HIGH-VELOCITY SHOCKS. Vernal Josephson (Los Alamos Scientific Lab., N. Mex.). J. Appl. Phys. 29, 30-2(1958) Jan.

High-velocity axial shocks have been produced in linear gas discharge systems by so shaping the discharge tube (and discharge) that a maximum amount of energy is coupled into the ionized gas before the shock is formed. Two methods of coupling energy into the gas are discussed along with their relative merits and shock velocities achieved by each method. (auth)

6651

SOME ASPECTS OF SURFACE BOILING. C. E. Faneuff, E. A. McLean, and V. E. Scherrer (Naval Research Lab., Washington). J. Appl. Phys. 29, 80-4(1958) Jan.

An experiment is described in which the growth of vapor bubbles at a surface is followed in detail. Growth curves are obtained and shown to agree, within experimental error, with current theories of growth under idealized conditions, provided an average superheat present at the initiation of growth is sued in the calculation. A criterion is proposed to permit an estimate of a delay time for vapor formation. The estimated delays are found to be in qualitative agreement with those measured. (auth)

6652

APPLICATIONS OF POSITRONS IN STUDIES OF ELECTRONIC STRUCTURE OF METALS. E. Daniel. J. Phys. radium 18, 691-3(1957) Dec.

6653

THERMO-NUCLEAR FUSION. A SURVEY OF THE POSITION. Nuclear Eng. 3, No. 24, 95-101(1958) Mar.

A survey of the position of thermonuclear fusion in England, the United States, France, Germany, and Sweden is presented. (W.L.H.)

6654

NUCLEAR MAGNETIZATION IN THE PRESENCE OF ULTRASONIC EXCITATION. O. Kraus and W. H. Tantila (Michigan State Univ., East Lansing). Phys. Rev. 109, 1052-8(1958) Feb. 15.

The field gradient at the site of a nucleus resulting from a relative displacement of surrounding charge is expanded in a Taylor series. The resulting expression is used to calculate the transition probability induced by this displacement for transitions of quadrupolar nuclei between $\Delta m = \pm 2$ spin levels in a sodium chloride-type lattice. The equilibrium nuclear magnetization in the presence of ultrasonic and thermal lattice vibrations is derived on the assumption of fast mutual spin-flip processes. The derivation is also based on a strain-free lattice. (auth)

6655

ABSOLUTE CROSS SECTIONS FOR EXCITATION OF NITROGEN BY PROTONS OF A FEW kev ENERGY. N. P. Carleton and T. R. Lawrence (Harvard Univ., Cambridge, Mass.). Phys. Rev. 109, 1159-65(1958) Feb. 15.

Cross sections for excitation by proton impact are necessary for quantitative interpretation of auroral spectra. These have been measured for excitation resulting when protons of a few energy shoot into low-pressure nitrogen. Interference filters select various spectral features and a photomultiplier detects the light emitted. The light-detection apparatus is calibrated against a standard tungsten filament lamp. The measured cross sections are not for the excitation of a given molecular level, but for a process resulting in the emission of one photon in a given transition. Cross sections measured include: the 0,0 first negative band of N_2^+, λ3912; the 2,0 Meinel band of N_2^+, λ7850; a group of N I lines around λ8216; the Balmer line H_β; and the (4,2) and (3,1) first positive bands of N_2, excited by impact of fast atoms. Results are presented graphically, covering the range 1.5 to 4.5 kev. Also included are measurements of the total charge-exchange cross section for protons in nitrogen and an estimate of the ionization cross section. (auth)

6656

SIMULTANEOUS IONIZATION AND EXCITATION OF HELIUM BY PROTONS. Robert A. Mapleton (Air Force Cambridge Research Center, L. G. Hanscom Field, Bedford, Mass.). Phys. Rev. 109, 1166-72(1958) Feb. 15.

Born's approximation is used to calculate the cross sections for ionization and simultaneous ionization and excitation of helium by collision with protons. (auth)

6657

SEARCH FOR PAIR PRODUCTION BY PROTONS. W. E. Stephens and H. Staub (Univ. of Zurich). Phys. Rev. 109, 1196-9(1958) Feb. 15.

A search was made for pairs produced in the collision of heavy particles by bombarding tantalum with protons of

energy up to 1.64 Mev. Only a very small number of positrons was detected, giving an upper limit of 6×10^{-13} pair per proton at 1.54 Mev, in contrast to the theoretical value of 38×10^{-13} pair per proton obtained by Born approximation. (auth)

6658

EQUILIBRIUM DISTRIBUTION OF NITROGEN ION CHARGES. V. S. Nikolaev, L. N. Fateeva, I. S. Dmitriev, and Ya. A. Teplova. Soviet Phys. JETP 5, 789-92(1957) Dec.

The equilibrium distribution of charges in a beam of nitrogen ions after traversal of films of beryllium, celluloid, nickel and gold was determined in the energy range from 0.95 to 9.4 Mev. The dependence of the mean charge on the velocity was obtained. A small difference was detected in the charge distribution after traversal of various substances by the ions. (auth)

6659

ON THE INTERACTION BETWEEN LITHIUM IONS AND MATTER. Ya. A. Teplova, I. S. Dmitriev, V. S. Nikolaev, and L. N. Fateeva. Soviet Phys. JETP 5, 797-800(1957) Dec.

The following quantities have been measured for Li^7 ions possessing energies between 0.5 and 5 Mev: specific ionization in hydrogen and air, ranges in hydrogen, air and NIKFI Ia-2 photographic emulsions, and the equilibrium charge distribution after passage through a celluloid film. (auth)

6660

SHOCK WAVES OF LARGE AMPLITUDE IN AIR. Ia. B. Zel'dovich (Inst. of Chemical Physics, Academy of Sciences, USSR). Soviet Phys. JETP 5, 919-27(1957) Dec.

The state of air compressed by strong shock waves is examined by taking dissociation and ionization into account. Approximate expressions are given for the density and temperature in this region. The radiation from the front of the shock wave is considered. With increasing shock-wave amplitude, the observed surface temperature passes through a maximum, owing to the formation of an opaque layer of air, preheated by the radiation, ahead of the front of the wave. A proof is given of the non-existence of a continuous solution and of the unavoidability of discontinuities in the velocity, density, and temperature in a strong shock wave with radiative heat exchange. The wave structure is investigated in a strongly-ionized gas with allowances for the slow energy transfer between the ions and electrons. (auth)

6661

TECHNICAL THERMODYNAMICS AND HEAT EXCHANGE PRINCIPLES. A. I. Veinik. Moscow, State Publishing House of Scientific and Technical Literature on Ferrous and Non-Ferrous Metallurgy, 1956. 448p. (In Russian)

The basic concepts of technical thermodynamics and heat exchange and the latest data are reviewed. The elements of irreversible processes in thermodynamics are discussed. A detailed description is given of the basic ideas, the physical phenomena, and the practical applications of the theory. (R.V.J.)

Aerosols

6662

THE THEORY OF MOTION OF SMALL AEROSOL PARTICLES IN DIFFUSION FIELD. B. V. Deryagin and S. P. Bakanov (Inst. of Physical Chemistry, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 117, 959-62(1957) Dec. 21. (In Russian)

Cosmic Radiation

6663 INSJ-3

Tokyo Univ. Inst. for Nuclear Study.

A MEASUREMENT OF ENERGY FLOW IN THE EXTENSIVE AIR SHOWER. Tsuneo Matano, Isao Miura, Minoru Oda, Koichi Suga, Goro Tanahashi, and Yasuo Tanaka. June 13, 1957. 11p.

Electronic components of the extensive air shower develop cascade showers and dissipate energies in the material. Total amount of Cherenkov radiations emitted in the material is proportional to the sum of path lengths for these cascade showers that is again proportional to the energy carried by electronic components. Thus, the collection of Cherenkov light emitted in a thick material, which is as thick as essentially whole energy of electronic components dissipates as cascade showers, provides a means of measuring the energy flow in the extensive air shower. It is attempted in the present air shower project to measure the energy flow of the electronic component and Cherenkov detectors based on the above principle are prepared (called e-detector). Essential features of two kinds of e-detectors are given. (auth)

6664 SUI-58-3

Iowa. State Univ., Iowa City.

SOFT RADIATION EVENTS AT HIGH ALTITUDE DURING THE MAGNETIC STORM OF AUGUST 29-30, 1957. Kinsey A. Anderson. Jan. 1958. 40p.

The close connection between the appearance of x rays in the 100 kev energy region and storm type decreases in the local geomagnetic field is shown. The observation that bears on the point is consistent with these x rays being produced by electron bremsstrahlung in the terrestrial atmosphere. There are features of the x-ray behavior which show that the primary electrons must be local in character quite apart from geomagnetic cutoff considerations. By local is meant that the electrons either acquire the main part of their kinetic energy in the neighborhood of the earth or that they are accelerated at the sun, are trapped in magnetic clouds and drift to the earth where they are released. It is suggested that accelerations of electrons is a rather general characteristic of the region surrounding the earth and that their association with aurorae and geomagnetic storms may be special features. (auth)

6665 AEC-tr-2416

CONCERNING STABLE PARTICLES WITH MASS GREATER THAN THAT OF A PROTON IN COSMIC RADIATION AT AN ALTITUDE OF 3,250 METERS ABOVE SEA LEVEL. M. I. Dayon. Translated by Morton Hamermesh from Doklady Akad. Nauk. S.S.S.R. 101, 821-3(1955). 8p.

Measurements of the mass spectra of particles of cosmic radiation were made with a magnetic spectrometer in which the detection equipment is replaced by a large rectangular Wilson chamber. From the spectrum obtained of ionizing events, 19 particles from a total of 267 were observed whose mass corresponded to that of the deuteron. In the same series of measurements 104 non-ionizing stoppings of particles were seen. From the spectrum it was determined that 19 deuterons and 31 anomalous protons were recorded. (J.S.R.)

6666 TT-717

PHOTOFISSION OF HEAVY COSMIC RAY PARTICLES OCCURRING UNDER THE ACTION OF SOLAR RADIATION. (O Fotorasshcheplenii Tiazhelykh Chastits Kosmicheskikh Luchei, Proiskhodiashchem pod Vliianiem Solnechnogo Izlucheniia). G. T. Zatsepin. Translated by G. Belkov from Doklady Akad. Nauk S.S.S.R. 80, 577-8(1951). 5p.

This paper was previously abstracted from the original language and appears in Nuclear Science Abstracts, Vol. 6, as abstract No. 2402.

6667

A STUDY ON THE COSMIC RAY NUCLEAR INTERACTIONS IN LEAD AT 9000 FT. R. N. Mathur and P. S. Gill (Gulmarg Research Observatory, Kashmir, India). Indian J. Phys. 32, 19-25(1958) Jan.

Nuclear disintegration rates in lead plates of different thicknesses have been studied under no absorber and under 280 g/cm^2 of lead absorbers. The transition phenomena are exhibited by both the unfiltered and filtered N radiation. A comparative study, however, reveals a change in the characteristics of the N radiation when filtered through the absorber. Unfiltered N radiation shows a broad maximum around 25 g/cm^2 of Pb. For filtered N radiation, however, there appears to be an upward shift in the position of the maximum. The interaction mean free path of the unfiltered N radiation is obtained equal to 200 g/cm^2 of lead. Filtered N radiation, however, seems to have an interaction mean free path greater than 250 g/cm^2 of lead. The absorption mean free path of the N radiation is obtained as 340 g/cm^2 of lead. (auth)

6668

THE ELECTROMAGNETIC CASCADE WITH TRIDENTS. J. W. Gardner (English Electric Co., Ltd., Whetstone, Leicester, Eng.). Nuovo cimento (10) 7, 10-22(1958) Jan. 1.

Recent results claiming anomalously large cross sections for direct pair creation by high energy electrons (mainly above 10 Bev) are discussed with particular reference to their significance in the development of the electron-photon cascade. A qualitative estimate, using an admittedly crude model, suggests that the effect of such large trident cross sections could drastically change the pattern of development in the early stages of a really high energy cascade. The detailed analytical formulation of cascade theory is then modified in such a way that numerical values of the cross-section for trident production, when these are satisfactorily established, can be readily inserted in the formulas used for computing the moments of the number distribution function. (auth)

6669

ANALYSIS OF BURSTS PRODUCED BY MESONS. M. R. Gupta (Bengal Engineering Coll., Howrah, India). Nuovo cimento (10) 7, 39-52(1958) Jan. 1.

The contributions made by the μ and π^0 mesons to the frequency of burst production under a thick shield of materials have been calculated by making use of the recent results of the soft cascade shower theory. The theoretical results thus obtained have been compared with the observational data given by various authors. Satisfactory agreements between the theoretical and observational results are found everywhere, at high altitude, at sea-level and also underground, using Poisson's distribution for the fluctuation, and taking $\bar{N}(E = 2mc^2, t)$, as the average number of particles in a shower. Further it is seen that the burst calculations made with the above modifications lead one to decide unambiguously in favor of the $\frac{1}{2}$ spin theory of the μ meson, in contradistinction to the uncertainties met with previously while trying to determine the spin of the μ meson from the observed burst rates. The effects of taking $N(E = 0, t)$ for the average number of particles in a shower or of using a Furry distribution for the fluctuation, have also been estimated. (auth)

6670

THE AVERAGE MULTIPLICITY AND INELASTICITY IN π-MESON PRODUCTION IN THE ATMOSPHERE. G. Ishikawa and K. Maeda (Meteorological Research Inst., Tokyo). Nuovo cimento (10) 7, 53-66(1958) Jan. 1.

The energy spectra of primary and secondary cosmic radiation are analyzed to find the multiplicity-energy relation in the π-meson production in the atmosphere at the energy region from several Bev to some thousands Bev with the help of simplified considerations on the meson production by nucleus-nucleus collisions. The results being subjected to the assumed values of inelasticity suggest that the multiplicity-energy relation agrees with the formula of the type given by Fermi and Landau under the condition of a practically constant small inelasticity. (auth)

6671

FLUX OF SLOW μ-MESONS AND PROTONS NEAR THE GEOMAGNETIC EQUATOR. A. Subramanian, S. Naranan, P. V. Ramanamurthy, A. B. Sahiar, and Siddheshwar Lal (Tata Inst. of Fundamental Research, Bombay). Nuovo cimento (10) 7, 110-13(1958) Jan. 1.

6672

ORIGIN AND DYNAMICS OF COSMIC RAYS. E. N. Parker (Univ. of Chicago). Phys. Rev. 109, 1328-44(1958) Feb. 15.

As a consequence of the inability to observe directly the origin of a cosmic-ray particle, the development is begun with a discussion of the limitations within which a cosmic-ray accelerator mechanism can be constructed. Only the betatron effect and the Fermi mechanism can be allowed. Some of the many variations of these mechanisms which are to be found in the literature are reviewed. Then it is shown that trains of oppositely moving hydromagnetic waves of large amplitude and with sharp crests can accomplish large and continued particle accelerations which are adequate to maintain the observed galactic cosmic-ray field. The large acceleration arises as a consequence of the simple fact that each wave tends to sweep up the cosmic-ray particles before it, so that head-on collisions of particles with waves are much more common than overtaking collisions. It is pointed out that the sharp crests of the waves are a natural consequence of the observed supersonic mass motions. Therefore, the acceleration by oppositely moving waves does not depend upon any special wave form, and we suggest that it is the naturally occurring acceleration process. By treating the cosmic rays as a gas with relativistic thermal motions, it is shown that the cosmic-ray gas is effectively coupled to the motions of the ordinary matter both parallel and perpendicular to the magnetic field. Thus the effective speed of sound must be computed in the composite cosmic-ray and ordinary gas. It is noted that with this composite speed of sound the irregular mass motions in the galactic disk and halo are approximately Mach one. It is suggested that this represents a general dynamic balance to be found in all sufficiently active regions of space, and explains how it is that we often observe prolonged mass motions in the galaxy and in stellar atmospheres which would otherwise be computed to be highly supersonic and dissipative. The dynamic balance comes about from the fact that increased cosmic-ray density would reduce the effective Mach number below one, allowing the sharp crests of the hydromagnetic waves to degenerate, and thereby halting the production of cosmic-ray particles. (auth)

6673

PRIMARY COSMIC-RAY PROTON AND ALPHA FLUX NEAR THE GEOMAGNETIC EQUATOR. Frank B. McDonald (State Univ. of Iowa City, Iowa). Phys. Rev. 109, 1367-75(1958) Feb. 15.

The vertical flux of primary protons and of alpha particles has been measured at Guam, Marianas Islands (λ = 3°N) using a Čerenkov scintillation detector carried to a

residual pressure of 6.1 g/cm² by a Skyhook balloon. The primary alpha flux, $J_{\theta\alpha}$ was found to be, $J_{\theta\alpha} = 18.0 \pm 2$ particles/m²-sec-sterad at 0 g/cm² atmos depth. The flux of primary protons, $J_{\theta p}$ was found to be, as an upper limit (without returning albedo correction), $J_{\theta p} = 115 \pm 12$ particles/m²-sec-sterad at 0 g/cm² atmos depth, and as a lower limit (with returning albedo corrections), $J_{\theta p} = 95 \pm 12$ particles/m²-sec-sterad at 0 g/cm² atmos depth. This flight completes an extensive latitude survey of the alpha and proton components by this laboratory using identical detectors at all latitudes. The alpha energy spectrum can be represented from 0.150 Bev/nucleon to 7.3 Bev/nucleon by $J_{\theta\alpha}(\geq E) = -(1.5)(415)\int_E^\infty [1-\exp(-80E'^{-2})]/(1+E')^{2.5}\,dE'$ particles/m²-sec-sterad, where $J_{\theta\alpha}(\geq E)$ is the vertical flux of primary alphas with kinetic energy $\geq E$ (measured in Bev/nucleon). This energy spectrum is in excellent agreement with the measured low-energy alpha differential energy spectrum. Above 0.35 Bev/nucleon the alpha energy spectrum is accurately represented by $J_{\theta\alpha}(\geq E) = 415/(1+E)^{1.5}$ particles/m²-sec-sterad. The proton energy spectrum in the latitude range 0–41°N (15.2–4.0 Bev/nucleon) is well represented by $J_{\theta p}\ (\geq E) = 6600/(1+E)^{1.5}$ particles/m²-sec-sterad. Thus the flux of protons and alphas has the same energy dependence over a wide range of energies. Values of the flux of splash albedo at λ = 3°N are given and estimates are made of the magnitude of the returning albedo correction. (auth)

6674

GEOMAGNETIC COORDINATES AND COSMIC RADIATION. M. S. Vallarta, R. Gall, and J. Lifshitz (Instituto Nacional de la Investigación Cientifica e Instituto de Geofisica de la Universidad, Mexico, D. F.). Phys. Rev. 109, 1403–4(1958) Feb. 15.

Waddington, McDonald, and Fay have found that the geomagnetic cutoff in North America and in Europe does not agree with the values calculated from standard geomagnetic theory, but rather with those corresponding to a change of geomagnetic lattitude of the order of 4 to 5°. Independent evidence has been adduced by Simpson and the Chicago group as well as by Rose and the Ottawa group and has led them to propose a new system of "effective geomagnetic coordinates" for cosmic radiation. They have also given theoretical arguments to support their proposals. (A.C.)

6675

EXTRA-ATMOSPHERIC COSMIC RAY DOSAGE DURING THE LARGE SOLAR FLARE OF 23 FEBRUARY 1956. Hermann J. Schaefer (U. S. Naval School of Aviation Medicine, Pensacola, Fla.). Science 127, 186–7(1958) Jan. 24.

During the solar flare cosmic measurements were carried out on a world-wide scale Though most of the measurements were made at sea level and mountain altitudes, synoptic evaluation of observations made at different geometric latitudes permits inference to be drawn about extra-atmospheric intensity. This intensity was so large that it seems of interest to investigate what ionization might be encountered if human beings should be caught by a large solar flare in extra-atmospheric flight. The neutron intensity of cosmic radiation at sea level during the flare showed 36 times its normal value 21 minutes after the onset of visible activity on the sun and then returned to normal in about 20 hours. At the same time as the above measurements a balloon reaching 80,000 ft recorded 4-times normal total ionization. If a 3000% increase in the total ionization at 80,000 ft is reflected in a 15% increase in neutron intensity at sea level, the increase of ionization at great heights must have been tremendous. The implications of exposure hazards in interplanetary space during a large flare are ominous. (A.C.)

6676

MULTIPLE ELECTRON PRODUCTION IN A HIGH ENERGY ELECTRON-PROTON SHOWER. A. A. Varfolomeev, R. I. Gerasimova, and V. A. Tumanian. Soviet Phys. JETP 5, 792–6(1957) Dec.

An unusual electron-photon shower produced by an electron of $>10^{11}$ ev initial energy has been detected in a stack of emulsion layers without backing, exposed in the stratosphere. Experimental data obtained on the basis of a study of this shower are presented which indicate the occurrence of three cases of simultaneous formation of four electrons (two electron-positron pairs). (auth)

6677

DISTRIBUTION OF THE ELECTRON-PHOTON COMPONENT ON THE PERIPHERY OF EXTENSIVE AIR SHOWERS OF COSMIC RAYS. S. I. Nikol'skii and V. M. Seleznev (Academy of Sciences, USSR). Soviet Phys. JETP 5, 1019–21(1957) Dec.

The lateral distribution of charged particles in extensive atmospheric showers caused by particles with energies of $E_0 = 1.6 \times 10^{15}$, 5×10^{14}, and 1.6×10^{14} ev at ~100 m distances from axis was studied. To account for the electron-photon components in equilibrium with μ mesons, the number of μ mesons with energy $\geq$250 Mev multiplied by 1.3 was substracted from the total flux of charged particles at 100 to 500 m from the axis. The results for the showers with 7.4×10^5 and 7.7×10^6 electrons not in equilibrium with a μ meson are presented. The electron flux density at various distances from the axis and the theoretically calculated functions of lateral distribution are normalized to the same number of electrons at distances between 0 and 1000 m (2×10^5). (R.V.J.)

Crystallography and Crystal Structure

6678

MEASUREMENT OF LATTICE VIBRATIONS IN VANADIUM BY NEUTRON SCATTERING. C. M. Eisenhauer, I. Pelah, D. J. Hughes, and H. Palevsky (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 109, 1046–51(1958) Feb. 15.

The energy spectrum of slow neutrons inelastically scattered by vanadium metal has been measured by the time-of-flight technique. The neutrons gain energy by absorbing quanta of lattice vibration energy (phonons). As the nuclear scattering amplitude of vanadium is incoherent, the energy distribution of scattered neutrons is directly related to the frequency distribution of lattice vibrations. The measured neutron energy spectrum, as well as the derived frequency distribution, shows a clearly resolved double peak. This structure, which is distinctly different from the simple Debye distribution, but expected on the basis of detailed calculations, has heretofore not been amenable to direct measurement. The measured frequency distribution is compared with calculations for a body-centered cubic lattice by the Born-von Kármán theory and qualitative agreement is obtained. A more exact comparison awaits measurement of the elastic constants of vanadium. (auth)

6679

INTERNATIONAL CONFERENCE ON CURRENT PROBLEMS IN CRYSTAL PHYSICS, HELD AT MASSACHUSETTS INSTITUTE OF TECHNOLOGY ON JULY 1–5, 1957. Revs. Modern Phys. 30, 46–255(1958) Jan.

Papers are presented on: electron distribution determinations by x-ray diffraction; electron distributions in NaCl, LiF, CaF_2, and Al; an attempt to determine electron configurations in Al-rich alloys of transition metals; x-ray determination of the number of 3d electrons in Cu, Ni, Co,

Fe, and Cr; the variation of atomic wave functions with atomic number; critical magnetic scattering of neutrons by Fe; the theory of critical scattering; the theory of magnetic scattering of neutrons by CoO; the determination of H positions in crystals by neutron diffraction; empirical problems concerning atomic bonds; new x-ray and neutron studies of H bonding; neutron diffraction studies of H-containing crystals; theoretical and experimental investigations of the electronic energy band structure of solids; the crystal structure of naphthalene, anthracene, and benzene; the lattice vibrations of benzene, naphthalene, and anthracene; the thermal vibrations of atoms and molecules and the electron density distribution in crystals; temperature characteristic of x-ray intensity reflection from crystals having zincblende- and wurtzite-type structures; the vibrations of diatomic lattices; the interaction of waves in crystals; x-ray scattering by thermal agitation of atoms in a crystal; x-ray scattering by thermal agitation and the Compton effect in fluorite; electrical polarization of elastic waves in crystals and optical dispersion; Compton scattering of x-rays in crystals; lattice dynamics and thermal diffuse scattering of x-rays; normal modes of Al by neutron spectrometry; and vibration spectra of V and a Mn–Co alloy by neutron spectrometry. (M.H.R.)

Electrical Discharge

Refer also to abstract 7025.

6680

THERMONUCLEAR FUSION. BRITISH AND AMERICAN PROGRESS REPORT. Atomics and Nuclear Energy 9, 58-9(1958) Feb.

A summary of the types of attack made on the fusion problem in Britain and the U.S.A. is presented. The results and drawbacks are discussed. (M.H.R.)

6681

ON THE THEORY OF DIFFUSION OSCILLATIONS IN GAS DISCHARGE PLASMA. O. V. Prudkovskaya (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 117, 601-4(1957) Dec. (In Russian)

Analysis of the general dispersion equation of diffusion oscillations in real plasma indicated the presence of quasi-neutral waves for the cases where the Debian radius was of the order of 0.01 or 0.001 cm. The presence of electron waves propagating independently or ionic waves accompanied by electron motion was found in the weakly charged plasma with small Debian radius. (R.V.J.)

6682

EXCITATION OF PLASMA OSCILLATIONS AND GROWING PLASMA WAVES. G. D. Boyd, L. M. Field, and R. W. Gould (California Inst. of Tech., Pasadena). Phys. Rev. 109, 1393-4(1958) Feb. 15.

Recent laboratory work has been concerned with the experimental verification of plasma interaction theories which predict spatially growing waves in a plasma which is traversed by a beam of fast charged particles. This communication describes preliminary results of a new experiment in which the beam is moderated by a microwave signal before it interacts with the plasma. A very strong interaction is observed which shows essentially the theoretically predicted form of behavior. (A.C.)

6683

IGNITION OF THE HIGH VOLTAGE DISCHARGE IN HYDROGEN AT LOW PRESSURES. A. S. Pokrovskaya-Soboleva and B. N. Kliarfel'd. Soviet Phys. JETP 5, 812-18(1957) Dec.

It has been found that the striking voltages for discharges in hydrogen, corresponding to the left-hand branch of the Paschen curve, do not obey the similarity rules. After an ignition on the left-hand branch of the Paschen curve, the resultant high-voltage discharge is characterized by electrode voltage drops which are independent of the current. In hydrogen discharges, this constancy of voltage drop is maintained over a very wide range of currents. For discharges produced by 4-μsec voltage pulses, the transition from the high-voltage form to the arc takes place only at currents exceeding 1000 amp. (auth)

6684

CONTRIBUTION TO THE THEORY OF TRANSPORT PROCESSES IN A PLASMA LOCATED IN A MAGNETIC FIELD. E. S. Fradkin (P. N. Lebedev Inst. of Physics, Academy of Sciences, USSR). Soviet Phys. JETP 5, 956-66(1957) Dec.

The mean statistical characteristics (velocity, heat current, stress tensor, etc.) have been determined for transport phenomena in a plasma located in a magnetic field. (auth)

6685

ON THE THEORY OF BREMSSTRAHLUNG IN PLASMA AT HIGH TEMPERATURE. G. Hettner. Z. Physik 150, 182-97(1958). (In German)

The bremsstrahlung of an isothermic plasma was calculated for temperatures up to $10^{8°}$K. It is shown that the often used "weak" approximation is highly inaccurate. The temperature and frequency ranges in which there are important corrections concerning the finite expansion for ions and their finite distance were investigated. A method for the estimation of these corrections was given. As an example the bremsstrahlung spectrum of the mercury high pressure arc was calculated and compared with the experimental results. (tr-auth)

Electrons

Refer also to abstract 7024.

6686 ORNL-2454

Oak Ridge National Lab., Tenn.

BREMSSTRAHLUNG SPECTRA IN NaI AND AIR. C. D. Zerby and H. S. Moran. Mar. 11, 1958. 22p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

Calculations of the bremsstrahlung spectra resulting from electrons slowing down in NaI and air were made and are presented in graphical form. (auth)

6687

FOURTH ORDER MAGNETIC MOMENT OF THE ELECTRON. A. Petermann (Univ. of Copenhagen). Nuclear Phys. 5, 677-83(1958) Mar.

A more complete account is given of an estimation, by rigorous upper and lower bounds, of the fourth order magnetic moment of the electron which has already been published by the author. The method is illustrated for one typical term. Then the results of a more elaborate estimation are given. In the terminology used by Karplus and Kroll, the term symbolized by the diagram IIc is found to satisfy $\mu(\text{IIc}) = (-0.60 \pm 0.11)\ \alpha^2/\pi^2 - \frac{1}{2}\ (\alpha^2/\pi^2) \log \lambda^2/m^2$, in contradiction with the value $-3.18\ (\alpha^2/\pi^2) - \frac{1}{2}\ (\alpha^2/\pi^2) \log \lambda^2/m^2$ given by the previous authors. It has been found that the other terms are not in disagreement with Karplus and Kroll values. If one accepts them, then the total fourth order moment amounts to $\mu^{(4)} = (-0.39 \pm 0.11)\ (\alpha^2/\pi^2)$. One notes finally that this new value increases the Lamb shift by (0.82 ± 0.03) Mc/s and brings the fine structure constant to $1/\alpha = 137.0384$. (auth)

6688
BREMSSTRAHLUNG OF POLARIZED ELECTRONS. G. L. Visotskii, A. A. Kresnin, and L. N. Rozentsveig (Physico-Tech. Inst., Academy of Sciences, USSR). Soviet Phys. JETP 5, 883-7(1957) Dec.

The polarization properties of the bremsstrahlung arising when a polarized electron beam strikes a target are considered. It is shown that in this case the bremsstrahlung contains a circularly polarized component. For highly relativistic electrons which are completely polarized in the direction of motion, the circular polarization near the upper limit of the spectrum amounts to as much as 25%; multiple scattering of electrons in the target has practically no effect on this value. Equations have been derived for the polarization of bremsstrahlung photons produced by electrons of arbitrary energy. (auth)

6689
THE INFLUENCE OF POLARIZATION ON THE EFFECTIVE CROSS SECTIONS FOR MØLLER AND BHABHA SCATTERING. Klaus Böckmann, Gustav Kramer, and W. R. Theis. Z. Physik 150, 201-4(1958). (In German)

The polarization of electrons and positrons can be determined through scattering of oriented electrons. A knowledge of the scattering cross section is necessary. Experimental work was accomplished only for the special case of parallel or antiparallel orientation of the spins against each other. The differential effective cross section for the scattering of longitudinally polarized electrons and positrons by resting randomly polarized electrons was given explicitly. (tr-auth)

Gases

6690 NP-6597
American Rocket Society, New York and Brown Univ., Providence.
ON THE DIRECT DETERMINATION OF THE VISCOSITY OF GASES AT HIGH PRESSURES AND TEMPERATURES. J. Kestin. [1957]. 53p.

Presented at the Second Biennial Gas Dynamics Symposium, Evanston, Ill., Aug. 26-28, 1957.

The paper gives a critical review of the most important methods for the experimental investigation of the viscosity of gases at high pressures and temperatures. The paucity of experimental data at combined high pressures and temperatures is stressed and the need for a considerable effort in this direction is brought into relief. The paper establishes general criteria for a successful viscometer for gases at high pressures and temperatures and it is shown that the capillary viscometer offers the best choice at the present time. The two possible alternatives, the oscillating-body and the falling-body viscometer require an intensive period of development before their potential could be accurately assessed. The main difficulties encountered in their use are connected with the complexities of the flow field which they create. In the former, secondary motion causes the scattering of data and inferior reproducibility. In the latter, vortex shedding and pressure drag contribute unaccountable terms to the skin friction force. At the end of the paper some consideration is given to the problem of empirical correlation of experimental data. In particular it is shown that the well-known correlation between density and the residual viscosity $\mu-\mu_0$, i.e., the difference between its value at a given temperature and pressure, and the corresponding value at zero pressure shows signs of breaking down at high densities. (auth)

6691 NP-6608
Avco Mfg. Corp. Avco Research Lab., Everett, Mass.
HYPERSONIC GAS DYNAMIC CHARTS FOR EQUILIBRIUM AIR. Saul Feldman. Jan. 1957. 112p., 1 illus. Contract AF04(645)-18.

A collection of charts is presented for the equilibrium properties of air in several flow situations of interest in hypersonic flow. The cases considered are: flow over bodies in flight at hypersonic speeds; normal and oblique shocks; and flow over bodies in shock tubes. This includes moving, standing, and reflected normal shocks as well as oblique shocks. A Mollier diagram is also included. (auth)

6692
RELATIVISTIC INCREASE OF ENERGY LOSS BY IONIZATION IN GASES. R. G. Kepler, C. A. d'Andlau, W. B. Fretter, and L. F. Hansen (Univ. of California, Berkeley). Nuovo cimento (10) 7, 71-86(1958) Jan. 1.

Measurements of ionization loss by relativistic charged particles have been made in helium, argon, and xenon. The experimental results agree well with theory in the case of helium. In argon, and particularly in xenon, the relativistic rise in ionization found experimentally is less than that predicted theoretically. The measurements were made by the method of counting drops in a cloud chamber. (auth)

6693
THERMAL DIFFUSION FACTORS FOR THE NOBLE GASES. Thomas I. Moran and W. W. Watson (Yale Univ., New Haven, Conn.). Phys. Rev. 109, 1184-90(1958) Feb. 15.

With an all-metal "Trennschaukel" of the type recently developed by Clusius and Huber, consisting of 22 tubes interconnected by single capillaries, and with the gas oscillating with a period of 15 sec, the thermal diffusion factor α for all of the noble gases as a function of temperature in the range 230 to 600°K was measured. The reduced thermal diffusion factors α_0 for krypton and xenon are positive even at the lowest temperature and increase so markedly with temperature as to indicate the advisability of operating isotope-separating columns with these gases with the cold wall at a somewhat elevated temperature. For neon the α vs. T curve has but a slight positive slope, while for helium α actually decreases as T increases in this range. The values of R_T (= ratio of observed α to its theoretical first-approximation value based on rigid elastic sphere molecules) agree quite well with those estimated from viscosity data except for helium. The intermolecular potential is best represented by a modified Buckingham (exp-six) potential with appropriately chosen parameters. (auth)

6694
NEGATIVE HELIUM IONS. P. M. Windham, P. J. Joseph, and J. A. Weinman (Univ. of Wisconsin, Madison). Phys. Rev. 109, 1193-5(1958) Feb. 15.

Negative helium ions have been produced with an ion source previously used for negative hydrogen ion production. Positive helium ions pass through a charge-exchange tube filled with hydrogen gas and the resulting negative ions are magnetically analyzed. The momentum spectrum indicates peak yields of negative helium ions in excess of 3.5×10^{-9} ampere under the conditions of this experiment. The yield of negative helium ions as a function of converter gas density suggests a possible mechanism for the creation of the negative helium ion. (auth)

Instruments

Refer also to abstract 7034.

6695 AECU-3468
Sandia Corp., Albuquerque, N. Mex.
ANALYSIS AND STABILIZATION OF JUNCTION TRANSIS-

TOR OSCILLATORS IN THE LOWER AUDIO RANGE. J. W. Ellis. Sept. 12, 1956. 16p. Contract [AT(29-1)-789]. (TM-189-56-14). $3.30(ph OTS); $2.40(mf OTS).

Transistor oscillators were analyzed using the low-frequency equivalent circuit for the transistor. Conditions for oscillation and expressions for the frequency of oscillation and for stability of frequency with variations in the parameters of the transistor were derived. In addition, conditions for reactance stabilization were determined. Oscillators of very low audio frequency were designed. Tests were made which indicate the excellent frequency stability with changes in temperature. (auth)

6696 MLM-CF-57-4-34
Mound Lab., Miamisburg, Ohio.
NUCLEAR BATTERY—THERMOCOUPLE TYPE. Quarterly Report No. 1 [for] January 1, 1957–March 31, 1957. B[ertram] C. Blanke. Mar. 31, 1957. 18p. DA Project No. 3-99-09-00. Contract R-50-799965-SC-01-91.

The potential usefulness as a heat source for the thermal battery of 1300 radioactive isotopes was investigated. All but thirty-two have been eliminated because of too long or too short a half-life and/or excessive gamma radiation of the isotope or element. Further eliminations are being made on the basis of relative availability and costs. (auth)

6697 SCTM-44-58(14)
Sandia Corp., Albuquerque, N. Mex.
OUTPUT SIGNAL-TO-NOISE RATIO IN PULSE SYSTEMS WITH AGC AND SATURATION. Charles S. Williams, Jr. Feb. 26, 1958. 57p. Contract AT(29-1)-789. $9.30(ph OTS); $3.60(mf OTS).

This memorandum is intended to extend and clarify the work in SCTM255-57(14) which dealt with post-detection signal-to-noise ratio in pulse systems; however, it is largely complete in itself. The original memorandum treated only the case of a steady signal in Gaussian noise in linear and square-law detection where no saturation occurred. Here, the case of a Gaussian signal in Gaussian noise is compared to the case just described. In addition, the effects of AGC and saturation are considered for those cases where the input consists of a Gaussian signal in Gaussian noise and of a steady signal in CW interference. (A few computational errors that arose in SCTM255-57(14) are corrected.) (auth)

6698 WAPD-A1W-P(CE)-3(Rev. 1)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
WATER HEIGHT MEASURING DEVICE. Larry A. Mikoleit. Oct. 1957. 6p. $1.80(ph OTS); $1.80(mf OTS).

A device for measuring the change in water height to an accuracy of ~ 0.001 inches is described in detail. A pointer is used to close an electrical circuit when it touches the surface of the water. A light and buzzer indicate when the circuit is complete. The drive knob for the pointer is calibrated so that one complete knob turn is 100 mils. (J.S.R.)

6699 WAPD-TH-287
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]
PRESSURE DROP THROUGH POTTER FLOWMETER. E. R. Quandt, Jr. and B. W. LeTourneau. Dec. 19, 1956. 4p. $1.80(ph OTS); $1.80(mf OTS).

The pressure drop through a Potter flowmeter was determined at various flow rates. Results of the pressure drop measurements are graphically shown as psi drop versus flow rate in gpm. A series of tests was also made with the rotor held stationary. These results indicate the power loss to be expected for this meter if the rotor accidentally jammed. Pressure drop for a stationary rotor was found to be approximately six times the normal drop at the same rate of flow. Flow rates as measured with the Potter meter and the loop Foster flow tube agreed within ± 2% over the recommended range of flows for the meters. (A.C.)

6700
SMALL GAS COMPRESSOR FOR ACCELERATOR ION SOURCES. Antonio Tanarro (Junta de Energía Nuclear, Madrid). Nuclear Instr. 2, 13-14(1958) Jan.

A simple, small-sized compressor designed to fill with deuterium the storage tank of the ion source in a pressurized Van de Graaff accelerator up to a pressure of five atmospheres is described. (auth)

6701
GAIN-SCANNED SINGLE CHANNEL KICKSORTER USING PRECISION CASCADE ATTENUATORS. C. F. Coleman (Atomic Energy Research Establishment, Harwell, Didcot, Berks). Nuclear Instr. 2, 44-8(1958) Jan.

The paper begins by discussing the characteristics and advantages of a single channel kicksorter in which the voltage channel is fixed, and the pulse spectrum is scanned by changing the gain of the preceding amplifier. Attenuators which can be operated in cascade and have a precision ≈ 0.2% have been developed for use in such an instrument. Examples of spectra obtained with an automatically scanned digital recording kicksorter of this kind are presented. They involve pulse height and counting rate ranges of up to 30:1 and up to 3000:1, respectively. (auth)

6702
MEASUREMENT OF VACUUM BY THE RADIOACTIVE METHOD. V. B. Brodskiy. Priborostroenie No. 7, 8-13 (1956). (Translated from Referat. Zhur. Khim. No. 4, 1957, Abstract No. 12241).

The fundamental theoretical and design principles of radioactive method of vacuum measurement in the absolute pressure range 10^{-2} to 10 mm Hg are considered. The method is based on determination of magnitude of ionic current flowing between electrodes of an ionization chamber, the gas inside of which is irradiated by a radioactive source of alpha particles; in so doing the possibility is utilized of attaining a linear correlation between ionic current and pressure. Tests have shown that the error of radioactive vacuum gage is ± 2%.

Isotopes

6703 AEC-tr-3094
ISOTOPES CATALOG. (Includes Supplement). Translated from a publication of the All-union State Trust Soyuzreaktiv, Ministry of Chemical Industry USSR, Moscow, 1957. 47p. $1.25(OTS).

6704
THE FABRICATION OF ONE KILOCURIE SOURCES OF Cs^{137}. B. F. Warner (U.K.A.E.A., Windscale, Eng.). Énergie nucléaire 1, 161-71(1957) July-Sept. (In French)

Because of the increasing demand for radiocesium, a process was perfected and a pilot plant constructed for the extraction of several thousand curies of Cs^{137} from solutions of fission products from nuclear installations. The pilot process and the apparatus used in the installations of the United Kingdom Atomic Energy Authority at Windscale are described. The practical results of the operation are discussed. (tr-auth)

6705
PRODUCTION OF RADIOISOTOPES IN POLAND. R. Plejewski (Inst. of Nuclear Research, Warsaw). Nukleonika 2, 631-40(1957). (In Polish)

Because of the approaching date for the startup of the

nuclear reactor, some techniques have been developed for the production of the radioisotopes Co^{60}, Ir^{192}, Tl^{204}, Tm^{170}, Au^{198}, I^{131}, P^{32}, S^{35}, C^{14}, and H^3. Special attention was paid to isotopes of high chemical and radiochemical purity. (tr-auth)

Isotope Separation

6706 AEC-tr-3160

A HIGH RESOLVING POWER ELECTROMAGNETIC ISOTOPE SEPARATOR FOR HEAVY ELEMENTS. L. A. Artsimovich, G. I. Shchepkin, V. V. Zhukov, B. N. Makov, S. P. Maksimov, A. F. Malov, A. A. Nikulichev, B. V. Panin, and B. G. Brezhnev. Translated from Atomnaya Energ. 3, 483-91(1957). 14p.

A description is given of the operating principles and basic parameters of an electromagnetic apparatus used in the separation of isotopes with a relative mass resolution of about 1/240. An axial symmetric magnetic field (focusing angle of 225°) is used in which the dispersion is proportional to the square of the focusing angle. A dispersion of the separating apparatus of 20 mm per 1% of the relative mass difference is obtained. The magnetic field of the apparatus is stabilized to 0.005% with the aid of an electron ray transmitter. Electron sources are produced with a vapor discharge of the operating and ballast substances for the separation of large and small amounts of the original isotope mixtures. Universal ion receptors have also been developed for the apparatus. Results of the separation of lead, uranium, and plutonium isotopes are given. The enrichment factor for the separation of lead isotopes is 300, while that of uranium and plutonium is ~ 1000. (auth)

6707

THE ELECTROMAGNETIC ISOTOPE SEPARATOR IN COPENHAGEN. K. O. Nielsen and O. Skilbreid (Univ. of Copenhagen). Nuclear Instr. 2, 15-33(1958) Jan.

An electromagnetic isotope separator of a 90° sector type with 800 mm radius and 50 kv accelerating voltage is described. The focusing properties and the possibility of concentrating the beam on a small area at the collector are discussed. Direct deposition and a sputtering method for collecting the isotopes are used. In both cases, separated samples for direct utilization in various apparatus for nuclear physics investigations can be obtained. A few applications are briefly described. (auth)

6708

SEPARATION OF HELIUM ISOTOPES BY RECTIFICATION AND THERMO-OSMOSIS. V. M. Kuznetsov (Inst. of Physical Problems, Academy of Sciences, USSR). Soviet Phys. JETP 5, 819-27(1957) Dec.

The main characteristics of a packed rectification column for separation of a He^3-He^4 mixture and of a filter for enriching the solution with the light helium isotope by means of the thermomechanical effect have been determined experimentally. The results are compared with theory. A brief description of a continuous-action double ray mass spectrographic gas analyzer is presented. (auth)

6709

EXPERIMENTS IN THE ENRICHMENT OF HELIUM WITH THE He^3 ISOTOPE. V. P. Peshkov (Inst. of Physical Problems, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 30, No. 5, 850-4(1956). (Translated from Referat. Zhur. Fiz. No. 2, 1957, Abstract No. 3526).

A description of equipment for the enrichment of natural He with the isotope He^3 by a factor of 10^5 to 10^6, using the thermo-mechanical effect and rectification, and also of an installation for concentrating the He^3-He^4 mixture, so as to obtain He^3 with a purity of 99.95 to 99.97%. An evaluation is made of the maximum possible degree of enrichment of the mixture by means of the thermomechanical effect under various conditions.

Mathematics

6710 AECU-3643

Westinghouse Electric Corp. Advanced Design and Development Dept., Kansas City, Mo.

TRANSIENT THERMAL STRESSES IN PRESSURE VESSELS. PART I. TRANSIENT TEMPERATURE DISTRIBUTION—DESCRIPTION OF COMPUTER PROGRAM. J. P. DeVries and R. C. Nicoll. Sept. 12, 1957. 60p. (ADD-57-8). $12.30(ph OTS); $4.50(mf OTS).

An IBM 704 computer program is described for the calculation of transient temperature distribution in axially symmetric solid or hollow bodies. It is the first part of Transient Thermal Stresses in Pressure Vessels. (auth)

6711 CERN-57-43

European Organization for Nuclear Research, Geneva.

CONSISTENCY PROBLEMS IN QUANTUM ELECTRODYNAMICS. G. Källén. Aug. 31, 1957. 42p.

Typical problems related to the mathematical consistency of a field theory is discussed with the aid of simple models. As an introduction, a scalar field in interaction with a c-number source is considered. The Lee model is next discussed. It owes its importance to the fact that it belongs to the very few non-trivial models that can be solved exactly, although it gives rise to two conflicting expressions for N^2. The introduction of the "ghost-state" results in an integral equation which is satisfied by the two expressions for N. The application of this model to quantum electrodynamics is given. The Landau method is next considered. The function $\pi(p^2)$ is discussed in some detail, and an estimate is made of its high energy behavior. Finally the vacuum expectation value of three operators is considered. (J.S.R.)

6712 WAPD-T-180

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]

THE WESTINGHOUSE ANALOG COMPUTER FOR STR SPATIAL FLUX DISTRIBUTION. Frank Engel, Jr. [1954?]. $1.80(ph OTS); $1.80(mf OTS).

6713

AN ANALOGUE COMPUTER FOR NUCLEAR POWER STUDIES. G. J. R. MacLusky (A.E.R.E., Harwell, Eng.). J. Brit. Nuclear Energy Conf. 2, 351-60(1957) Oct.

A new analog computer is described which has been constructed at the Atomic Energy Research Establishment (A.E.R.E.), Harwell. It is to be used for nuclear power studies and comprises three main sections, namely the reactor-kinetics section, the control-system section, and the thermal-system section. The design of these sections and their interconnection is described in detail, and brief reference is made to some of the problems which will be studied with this new computer. (auth)

6714

THE APPLICATION OF ANALOGUE METHODS TO COMPUTE AND PREDICT XENON POISONING IN A HIGH-FLUX NUCLEAR REACTOR. G. J. R. MacLusky (A.E.R.E., Harwell, Eng.). J. Brit. Nuclear Energy Conf. 2, 361-70(1957) Oct.

The process of xenon poisoning, and its relation to the operation of a high-flux nuclear reactor, are discussed. An analog computer which gives the present value of xenon poisoning, and an associated predictor which can be used to plan future reactor operations, are described. This

computer-predictor is to be used as a reactor operator's tool. (auth)

6715

EASY COMPUTATION OF ADJOINT FLUXES. Bertram Wolfe (General Electric Co., San Jose, Calif.). Nucleonics 16, No. 3, 121(1958) Mar.

Machine codes to solve equations for the ordinary flux can be used to calculate adjoint fluxes by merely changing some of the imput data. A scheme for relabeling is given. (J.S.R.)

6716

THE CELLULAR METHOD FOR A CLOSE-PACKED HEXAGONAL LATTICE. II. THE COMPUTATIONS: A PROGRAM FOR A DIGITAL COMPUTER AND AN APPLICATION TO ZIRCONIUM METAL. S. L. Altmann (Univ. of Oxford). Proc. Roy. Soc. (London) A244, 153-65(1958) Mar. 11.

The techniques for fitting boundary conditions in the cellular method are discussed. A difficulty that has often arisen in this respect is illustrated and its origin explained. A new method is introduced that involves the development of a technique for dealing with a least squares problem for a system of homogeneous equations subject to a subsidiary condition. A program for a digital computer is described which carries out the cellular computation in an entirely automatic fashion. As a part of this program, a simplified method to integrate Schrödinger's radial equation in floating-point form is described. The energy eigenvalues for all the 12 irreducible representations for k = 0 for zirconium metal are given. (auth)

Measuring Instruments and Techniques

Refer also to abstracts 6879 and 7052.

6717 HASL-4

New York Operations Office. Health and Safety Lab., AEC.
TRANSISTORIZATION OF NUCLEAR COUNTING CIRCUITS. R. T. Graveson and H. Sadowski. Aug. 19, 1957. 19p. $0.75(OTS).

The advantages of long operational life, low power drain and miniaturization may be realized in nuclear counting circuits through the use of transistors. The disadvantage of instability, due to the effects of temperature change in the transistor, may be minimized in counting circuit designs. The predominant effects are a change in the grounded emitter current gain and a variation of the leakage current through the transistor. The binary circuit is analyzed for stability criteria, and testing procedures are suggested. Representative circuits of a binary stage, amplitude discriminator, one shot multivibrator, and ratemeters are included. (auth)

6718 HW-51783

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
A SCINTILLATION FAST NEUTRON EXPOSURE-RATE METER. W. G. Spear. Jan. 8, 1958. 23p. Contract [W-31-109-Eng-52]. $4.80(ph OTS); $2.70(mf OTS).

A scintillation fast neutron exposure rate meter has been developed to give a flat response from 1.0 Mev to at least 5.2 Mev fast neutrons with a reading error over this range of ±10%. The instrument employs three ranges of 0 to 2.5, 0 to 25, and 0 to 250 mrad/hr of fast neutrons. The instrument is transistorized, weighs six pounds, and has a battery life of at least 250 continuous hours. (auth)

6719 NYO-4699(Suppl. 1)

New York Operations Office. Health and Safety Lab., AEC and Division of Research, AEC.
STRAY RADIATION MEASUREMENTS AT PARTICLE ACCELERATOR SITES. J. E. McLaughlin, Jr., Keran O'Brien, Leonard R. Solon, Albert V. Zila, Wayne M. Lowder, and Hanson Blatz. 82p. $2.25(OTS).

Stray radiation measurements made at 23 particle accelerator sites are summarized and discussed. Conclusions with regard to safe accelerator operation are drawn, as well as general conclusions regarding radiation dosimetry, maximum permissible levels, and instrumentation. (auth)

6720 TOI-57-16

Technical Operations, Inc., Burlington, Mass.
SCATTERING OF GAMMA RAYS NEAR AN INTERFACE. Eric T. Clarke and Paul I. Richards. July 1957. 58p. Contract AF29(601)-178. (AFSWC-TR-57-3; AD-96304).

Scintillation counter measurements of gamma ray flux from sources of Na^{24}, Co^{60}, and Au^{198} immersed in water are reported. Data are presented showing variation in flux with depth of source and of detector for separation distances up to 20 mean free paths in water. It is shown that near the surface the predominant source of gamma rays is air scatter, particularly at large separation distances. (auth)

6721 USNRDL-TR-198

Naval Radiological Defense Lab., San Francisco.
RADIATION RECEIVED BY AN UNCOLLIMATED RECEIVER FROM A 4-PI SOURCE. M. G. Gibbons. Nov. 15, 1957. 21p. (AFSWP-1062).

The relative amounts of scattered visible radiation received from a 4π source by an uncollimated receiver are computed for receiver acceptance angles from 0 to 180° and for various optical thicknesses and scattering functions. A uniform infinite atmosphere is assumed, and only single scattering is taken into account. Calculations are made for phase functions representative of an extremely clear atmosphere, a hazy atmosphere, and a murky atmosphere. The ranges of optical thickness for which calculations are made with these phase functions are 0.033 to 1.2, 0.1 to 3.6, and 0.3 to 10.8, respectively. The ratio of the amounts of scattered and direct visible radiation received is computed for a hazy atmosphere and for the full range of receiver acceptance angles. The computed ratio is compared with experimental results published by other investigators and preliminary experimental results obtained by the writer. (auth)

6722 WAPD-TM-111

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE USE OF ISOMERIC STATES FOR NEUTRON THRESHOLD DETECTION. Daniel Klein. Feb. 1958. 10p. Contract AT-11-1-GEN-14. $0.50(OTS).

Particle reactions such as (n,p), (n,α), (n,2n), and fission detectors such as U^{238} and Np^{237} foils are the principal sources of fast neutron detection by activation techniques. A fast neutron detection method which makes use of the existence of isomeric states in certain elements is described. Since the Pb^{204} isomeric excitation is due primarily to neutrons, it makes a good threshold detector. The threshold is approximately 2.2 Mev, but the average excitation energy is probably closer to 5 Mev. The detectors can be used for fast flux measurements. If the excitation function were known, the function $\int_{2.2\ Mev}^{10\ Mev} \sigma\varphi dE$ could be compared with the theoretical estimate of this integral using fluxes obtained from a multigroup approximation to the transport equation. (auth)

6723

A SUBSTANDARD CONDENSER DOSEMETER AND ITS CALIBRATION AGAINST FOUR NATIONAL FREE-AIR

STANDARD CHAMBERS. R. Thoraeus (Karolinska Sjukhuset, Stockholm). Acta Radiol. 48, 473-83(1957) Dec.

The design and measuring properties of a substandard condenser dosemeter is described. The instrument has been used for about ten years, during which period it has been calibrated against four national free-air standard chambers. Some test results and the calibration factors obtained are presented. The series of calibration factors agree with ± 1.5 per cent. (auth)

6724

INTERCOMPARISON OF FRENCH AND U. S. ROENTGEN RAY STANDARDS. A. Allisy, L. DeLaVergne and H. O. Wyckoff (Ecole Normale Superieure, Paris, and National Bureau of Standards, Washington). Acta Radiol. 48, 484-92(1957) Dec.

6725

GLASS DOSIMETRY OF SOFT X RAYS. Tor Brustad and Thormod Henriksen (Norwegian Radium Hospital, Oslo). Brit. J. Radiol. 31, 163-6(1958) Mar.

The results of an investigation of the radiation-induced coloration of commercially available glass microscope coverslips as a dosimetric system for 35 kev x rays are given. A dose range of $1{\cdot}5 \times 10^3$ to $1{\cdot}4 \times 10^7$ r has been used. Special attention has been paid to correction for fading during and after the exposure. A mathematical interpretation of the calibration curves is arrived at. (auth)

6726

SENSIBILITY AND RAPIDITY OF THE EVAPORATION METHOD FOR MEASUREMENT OF THE RADIOACTIVITY OF WATER RESIDUE. P. Cohen, A. Reiffsteck, and G. Wormser. Énergie nucléaire 1, 20-3(1957) Jan.-Mar. (In French)

A rapid evaporation method is described for the radiometric analysis of water contaminated with Sr^{90} at the permissible limit of contamination. The total analysis time is two hours. (tr-auth)

6727

DOSIMETRY OF IONIZING RADIATIONS. G. Failla and R. Catolla Cavalcanti (Columbia Univ., New York). Minerva Nucleare 1, 275-80(1957) Nov.-Dec. (In Italian)

Estimation of absorbed radiation dosage by means of induced ionization is illustrated. Details of the Bragg-Gray relation are discussed, and optimal conditions of measurement are indicated with particular reference to the significance of W_{air} and S_{air}^{solid} parameters. The subject is treated in the terms of an extrapolation chamber with parallel plates, in order to facilitate the understanding of the procedure, and because of the fact that the necessary conditions are more precisely obtained by this type of ionization chamber. An extrapolation method is described for the determination of S_{air}^{solid} values for solids, whose atomic composition of gases may be duplicated, within the field of energy of ionizing particles in which the effect of density on slowing down capacity may be neglected. For this purpose, relative values of W are required for the gas equivalent to the solid matter referred to air. Experimental values obtained for N_2, O_2, CO_2, C_2H_2, C_2H_4, CH_4 by using beta particles of Ni^{63}, S^{35}, Tl^{204}, and P^{32} show that for each gas the S_{air}^{gas} value is quite constant (for E_{max} ranging from 0.063 to 1.7 Mev). (auth)

6728

AUTOMATIC SINGLE-CHANNEL PULSE-HEIGHT ANALYSER. P. A. Tove (Univ. of Uppsala). Nuclear Instr. 2, 1-4(1958) Jan.

An automatic single-channel pulse-height analyzer is described. It works with a variable step attenuator to give 300 channel positions and has constant relative channel width. (auth)

6729

IONIZATION CHAMBER RADIOISOTOPE COMPARATOR. Richard I. Weller (Brookhaven National Lab., Upton, N. Y.). Nuclear Inst. 2, 5-8(1958) Jan.

A precision instrument for the routine measurement of liquid beta-emitting radioisotopes was developed by modifying a portable Chang and Eng fast neutron detector. The battery-powered unit is rugged and dependable, and assays can be made rapidly. The minimum radioactivity measurable is of the order of 0.1 microcurie per milliliter and extends upward by a factor of 10^3. The inherent accuracy of the comparator is within ± 2% and the over-all absolute accuracy is estimated as ± 5%. (auth)

6730

STUDY OF SOME CHARACTERISTICS OF THE GM-DISCHARGE. J. Koch (Central Research Inst. for Physics, Budapest). Nuclear Instr. 2, 34-8(1958) Jan.

The G-M pulse was investigated in the case of a small working resistance such as is commonly used in a quenching circuit. The experimental results are interpreted on hand of a new model of the G-M discharge. (auth)

6731

AUTOMATIC COUNTING-RATE RECORDER. M. A. Pomerantz and A. E. Smith (Franklin Inst., Swarthmore, Penna.). Nuclear Instr. 2, 49-52(1958) Jan.

A counting-rate recorder, originally designed for a cosmic-ray neutron monitor station, incorporates a scale-shifting arrangement which automatically changes the sensitivity as required in accordance with the input counting rate. (auth)

6732

25-CHANNEL TIME ANALYZER FOR THE mμs RANGE AND A SIMPLE TIME TO PULSE-HEIGHT CONVERTER. Bertil Johansson (Nobel Inst. of Physics, Stockholm). Nuclear Instr. 2, 61-8(1958) Jan.

A multi-channel system is described which consists of 25 equal coincidence circuits. The time separation is carried out by a lumped delay-line. Because the delay-line can easily be exchanged, the arrangement can be used in a wide time-range. A simple time-to-pulse-height converter is described which is a variant of the above 25-channel analyzer. (auth)

6733

NEUTRON DETECTORS FOR OPERATION AT 400°C. Stefan G. Kaufmann and Leroy E. Pahis (Argonne National Lab., Lemont, Ill.). Nucleonics 16, No. 3, 90, 92-3(1958) Mar.

A study of the instrumentation needs of the contemplated second Experimental Breeder Reactor indicates the advantages of neutron detectors that can operate at elevated temperatures. The design of an ion counter is described. Performance tests were made to determine its operating characteristics at 400°C. Aging effects and the background current as a function of temperature and voltage were measured. Measurements have not yet been made at high fluxes. (J.S.R.)

6734

ORGANIC-GLASS SCINTILLATORS. John W. Downs and Forrest L. Smith (Wright Air Development Center, Wright-Patterson Air Force Base, Ohio). Nucleonics 16, No. 3, 94-6(1958) Mar.

A study was made of two organic silane compounds, triphenyl-p-biphenylylsilane and phenyltri-p-biphenylylsilane, to determine their effectiveness as scintillators. The physical properties and the preparation of the glass specimens are described. Their efficiency relative to a single crystal of anthracene when exposed to gamma radiation is about 60%. Emission from the silane glass appeared

to occur throughout the visible region. No specific absorption bands were observed between 3,000 and 9,000A. (J.S.R.)

6735

GAMMA-DOSE ENHANCEMENT FROM NEUTRON CAPTURE IN Cd. D. E. Kline and F. J. Remick (Pennsylvania State Univ., University Park). Nucleonics 16, No. 3, 97-101(1958) Mar.

It is often desirable to reduce the intensity of the thermal neutrons in many reactor experiments. A common method to eliminate the thermal neutrons is to wrap a thin shield of Cd around the sample to be irradiated. However, this results in an additional gamma dose rate in the specimen. A measurement of the effect of the Cd(n,γ) reaction was made for the Pennsylvania State University's pool-type reactor. The data showed how the gamma dose enhancement depends on the rate of thermal neutron absorption in the cadmium. (J.S.R.)

6736

SHRINKAGE OF NUCLEAR RESEARCH EMULSIONS. W. M. Gibson and J. G. McEwen (Queen's Univ., Belfast). Nuovo cimento (10) 7, 67-70(1958) Jan. 1.

A method is described for obtaining accurate values for the shrinkage factor of nuclear research emulsions, and for testing the uniformity of the shrinkage with depth. The results obtained from one plate show a shrinkage factor near the surface 6% greater than near the glass. The importance of avoiding such variations, when accurate depth measurements are required, is stressed. (auth)

6737

PHOTOMETRIC ANALYSIS OF THE TRACKS IN THE NUCLEAR EMULSIONS. II. MEASUREMENT OF PHOTOMETRIC WIDTH. P. G. Bizzeti and M. Della Corte (Istituto di Fisica dell'Università, Florence). Nuovo cimento (10) 7, 231-9(1958) Jan. 16.

A simple and speedy method for the measurement of the photometrical width of the tracks in nuclear emulsions is described. The independence of this parameter from depth is tested; corrections for dipping tracks are also calculated under reasonable assumptions and successfully compared with experimental results. (auth)

6738

SOME NEW POSSIBILITIES OF IONIC PHENOMENA IN METASTABLE LIQUIDS. G. A. Askar'yan (P. N. Lebedev Physics Inst., Academy of Sciences, USSR). Soviet Phys. JETP 5, 1011-13(1957) Dec.

New methods of revealing the presence of single ions, based on the principle of stratification of a working liquid composed of heterogeneous components in ion fields, were examined. (R.V.J.)

6739

THE DETERMINATION OF THE THYROID GLANDULAR WEIGHT WITH A SCINTILLATION DETECTOR AFTER A DOSE OF RADIOIODINE. A CONTRIBUTION TO THE THERAPEUTIC ADMINISTRATION OF RADIOIODINE. Paul Doering and Karl Kramer (Der Medizinischen Universitätsklinik, Göttingen, Germany). Strahlentherapie 105, 245-59(1958). (In German)

Prerequisite for the determination of radiation doses in thyroids after administering radioiodine is the knowledge of the thyroid weight. Scintigraphy and the use of adequate lead collimators provide the means of portraying true size and form of the thyroid. After examining 51 different size thyroids of corpses, a relation can be established between front surface and weight of the thyroid. The author points out methodical assumptions of exact surface reproduction in the scintigram. The inhomogeneous distribution of radioiodine in the gland and varying ray sensibility of the thyroid cell curtail the value of deducted dose formulas for therapeutic administering of radioiodine. (auth)

6740

INSTRUMENT FOR AUTOMATIC REGISTRATION OF RADIOACTIVE RADIATION. V. N. Afanas'yev. Zavodskaya Lab. 22, No. 7, 862-6(1956). (Translated from Referat. Zhur. Khim. No. 4, 1957, Abstract No. 12261).

The essential parts of the unit are the automatic recording device and impulse registering instruments. By means of terminal cut-out switches of the carriage and a simple relay system operation is effected under conditions of continuous registration of varying flow of radiation from a single source as well as under conditions of periodical recording of radiation of each of the specimens being compared.

Mesons

6741 INS-PT-2

Tokyo Univ. Inst. for Nuclear Study.

ISOTOPIC SPIN AND STRANGE PARTICLES. Gyo Takeda. Dec. 1, 1957. 26p.

Some properties of strange particles which remain unexplained after the introduction of the strangeness quantum number and the isotopic spin are: some experimental information about the isotopic change in decay, the mass spectrum of baryons, and the problem of possible parity nonconservation in strange particle decays in general. These properties are used to advance the theory of strange particles beyond the Nishijima–Gell–Mann theory at least on phenomenological ground. It is shown that the study of isotopic spin in connection with the above three problems seems to be particularly promising. It is assumed that the isotopic spin is conserved in every strong interaction. (M.H.R.)

6742 AEC-tr-2833

PION PAIR PRODUCTION BY GAMMA RADIATION AND PION BREMSSTRAHLUNG. Yu. A. Vdovin. Translated from Doklady Akad. Nauk S.S.S.R. 105, 947-9(1955). 5p.

Gamma radiation resulting from the collisions of fast pions with nuclei and the production of pion pairs by high-energy gamma rays impinging on nuclei were investigated. (auth)

6743

EFFECTIVE CROSS SECTION OF μ MESON PASSAGE FROM PROTON TO DEUTERON. S. S. Gershtein. Doklady Akad. Nauk S.S.S.R. 117, 956-8(1957) Dec. 21. (In Russian)

In previous studies it was shown that the catalysis of the nuclear reaction $p + D = He^3$ by the μ meson depended on the concentration of deuterium and could be determined by the basic process of μ meson transitions from protons to deuterons. The effective cross section for the process was calculated. (R.V.J.)

6744

ABOUT A CASE OF τ MESON DECAY WITH THE FORMATION OF ELECTRON-POSITRON PAIR. A. A. Nomofilov. Doklady Akad. Nauk S.S.S.R. 118, 59-60(1958) Jan. 1.

Observations of stacked emulsions irradiated in the stratosphere revealed a case of heavy meson decay during the formation of a π^+ meson and an electron-positron pair. At the point of formation of the π^+ meson the track stopped and initiated a sharp turning track of $\sim 540\mu$. Measurements were made of the densities of the heavy meson tracks and of the calibrated π-meson tracks to determine if the phenomenon is a π-meson decay or the scattering of a μ meson. A table of geometric data and results of measurements are

included. The examined case is obviously the τ' meson $\tau' \rightarrow \pi^+ + \pi^0 + \pi^0$ with the decay $\pi^0 \rightarrow \gamma + e^+ + e^-$. (R.V.J.)

6745

ON THE SPIN OF τ MESON. G. I. Plebanskii (Inst. of Physics, Polish Acad. of Sciences). Doklady Akad. Nauk S.S.S.R. 118, 65-7(1958) Jan. 1. (In Russian)

Spin 2^+ is the only spin which permits particle decay with conservation of parity for two and three π mesons. The experimental data for the τ^+ decay based on R. Dalitz (Proc. Phys. Soc. 64, 710(1953)) showed that the τ meson does not possess such spin. However, further analysis was made of decay within different limits. The results obtained for spin 2^+ and 0^- coincided with those of R. Dalitz, while the curves obtained for spin 2^- depended strongly upon the free parameter ν and when correct selection of parameter value ($\nu = -\frac{1}{4}$) was found agreed well with the experiment. (R.V.J.)

6746

ANGULAR DISTRIBUTION IN REACTIONS INVOLVING THE FORMATION OF THREE LOW ENERGY PARTICLES, WITH APPLICATION TO τ^+ MESON DECAY. V. N. Gribov (Physico-Tech. Inst. of the USSR Academy of Sciences, Leningrad). Nuclear Phys. 5, 653-68(1958) Mar.

The effect of interaction in the final state on the angular distribution in reactions involving the formation of three low energy particles is considered. In the case of nonresonance interaction the angular distribution can be expressed in terms of scattering amplitudes of pairs of particles. It is shown how the meson-meson scattering amplitudes can be deduced from the angular distribution of the decay products of the $\tau^+ \rightarrow 2\pi^+ + \pi^-$, $\tau^+ \rightarrow 2\pi^0 + \pi^+$ reactions. Experimental data presently available are insufficient for determining these amplitudes. (auth)

6747

NOTE ON THE PROPERTIES OF THE μ-MESON. S. Hirokawa and H. Komori (Nagoya Univ., Japan). Nuovo cimento (10) 7, 114-15(1958) Jan. 1.

From an analysis of cosmic-ray bursts, in a previous study, it was concluded that the anomalous magnetic moment of the μ meson does not exceed 80% of the normal Dirac moment. In the present study the above conclusion is justified. (A.C.)

6748

ON THE Σ-HYPERON-NUCLEON INTERACTION CROSS-SECTION. II. F. Ferrari and M. Tonin (Istituto di Fisica dell'Università, Padua and Istituto Nazionale di Fisica Nucleare, Padua). Nuovo cimento (10) 7, 123-7 (1958) Jan. 1.

6749

A SEARCH FOR THE EXISTENCE OF ASYMMETRIES IN POSITIVE K-MESON DECAY. A. Wataghin (H. H. Wills Physical Lab., Bristol, Eng.) and G. Alexander and R. H. W. Johnston (Dublin Inst. for Advanced Studies. Nuovo cimento (10) 7, 128-31(1958) Jan. 1.

6750

CROSS SECTIONS FOR K^--p INTERACTIONS. R. G. Glasser and N. Seeman (U. S. Naval Research Lab., Washington) and G. A. Snow (U. S. Naval Research Lab., Washington and Brookhaven National Lab., Upton, N. Y.). Nuovo cimento (10) 7, 142-6(1958) Jan. 16.

Nine $K^- + p$ elastic scattering events and eight $K^- + p \rightarrow \Sigma^\pm + \pi^\pm$ events have been observed in nuclear emulsion. These events yield $\sigma_{(K^-+p \rightarrow K^-+p)} = 33^{+13}_{-9}$ mb and $\sigma_{(K^-+p \rightarrow \Sigma^\pm+\pi^\mp)} = 29^{+12}_{-9}$ mb averaged over the energy region 0 to 82 Mev. The data indicate that $\sigma_{(K^-+p \rightarrow \Sigma^\pm+\pi^\mp)}$ rises as the K^- energy decreases. (auth)

6751

INTERACTIONS AND DECAYS OF K^--MESONS. E. Lohrmann, M. Nikolić, M. Schneeberger, P. Waloschek, and H. Winzeler (Physikalisches Institut der Universität, Bern). Nuovo cimento (10) 7, 163-70(1958) Jan. 16.

Results on interactions in flight, elastic scatterings, and decays of K^- mesons in nuclear emulsion in the energy interval between 5 and 130 Mev are given. A total K^- path of 112 m was followed. 11 K^--proton elastic scatterings and 5 K^--(free) proton absorptions were found. The differential cross section for elastic scatterings by complex nuclei for the two average energies of 45 and 100 Mev are listed. The mean free path for star production in the energy interval from 20 to 130 Mev is (27.7 ± 1.4) cm. The secondary tracks of the stars were, as far as possible, identified. 3 K^- reemissions were observed. Finally the K^- lifetime and some identified decays are discussed. From one of the two τ^- mesons observed a mass value of (966.0 ± 1.8) m_e was obtained. One possible example of the $K_{\pi 2}$ decay mode was found. (auth)

6752

ON POSSIBLE REGULARITIES UNDERLYING THE SCHEME OF ELEMENTARY PARTICLE STATES. N. Dallaporta (Istituto di Fisica dell'Università and Istituto Nazionale di Fisica Nucleare, Padua). Nuovo cimento (10) 7, 200-14 (1958) Jan. 16.

An approach is made in order to interpret the observed regularities of the known states of elementary particles by assuming that by disregarding secondary perturbations to which the differences of mass between baryons are attributed, the fundamental properties of all baryons should be the same; particularly all baryons should be spinors and isospinors. It is assumed that the only possible transitions between baryonic states are those indicated by dotted lines on the scheme, the horizontal lines being due to emission or absorption of $\pi^\pm$ mesons, the vertical ones to that of K^0 or $\overline{K}^0$ mesons and the diagonal ones to $K^\pm$ mesons. These transitions are ruled by three $\frac{1}{2}$ isospins, τ for pions, ω for K^0, ζ for $K^\pm$, with a similar formalism for each as used for ordinary isotopic spin; the three τ, ω and ζ spins representing internal degrees of freedom of the baryon, the quantum number labels for each baryonic state due to these spins being indicated in the brackets for each baryon as $(\tau_3, \omega_3, \zeta_3)$. It is shown that these assumptions are equivalent to the Gell-Mann Nishijima rules and that when suitable perturbations between the mesonic fields are introduced, the doublets $\Sigma^+ Z^0$ and $Y^0 \Sigma^-$ are mixed and give the singlet Λ^0 and the triplet $\Sigma^{+,0,-}$ states as observed; the hamiltonian then goes even into the form proposed by d'Espagnat and Prentki. Finally the physical meaning for the three quantum numbers of the baryons is discussed. (auth)

6753

EXPERIMENTAL DETERMINATIONS OF THE Λ^0 AND Σ^- SPINS. F. Eisler, R. Plano, A. Prodell, N. Samios, M. Schwartz, and J. Steinberger (Columbia Univ., New York and Brookhaven National Lab., Upton, N. Y.); P. Bassi, V. Borelli, G. Puppi, H. Tanaka, P. Waloschek, and V. Zoboli (Istituto di Fisica dell'Università, Bologna); M. Conversi, P. Franzini, I. Manelli, R. Santangelo, and V. Silverstrini (Istituto di Fisica dell'Università, Pisa, Italy); and G. L. Brown, D. A. Glaser, and C. Graves (Univ. of Michigan, Ann Arbor). Nuovo cimento (10) 7, 222-30(1958) Jan. 16.

The applicability of the argument of Adair to the determination of the hyperon spins on the basis of the observed distribution in the production angle for the process $\pi + N \rightarrow Y + 0$ is discussed. Because of the pronounced backward and forward peaking of these distributions it is found possible to use a large fraction of the events without

jeopardizing the validity of the argument. Measurement of the distribution in the correlation angles between incident and outgoing pions shows that the spins of both the Λ^0 and Σ hyperons are one-half. The only assumptions necessary to this result are (1) that the θ spin is zero and (2) that the interaction radius for strange particle production is not pathologically large. (auth)

6754

NON-CONSERVATION OF PARITY IN THE RADIATIVE π-MESON DECAY. G. W. Bund and P. Leal Ferreira (Instituto de Fisica Teórica, Sao Paulo, Brasil). Nuovo cimento (10) 7, 246-8(1958) Jan. 16.

The radiative decay of the charged π mesons ($\pi^{\pm} \rightarrow \mu^{\pm} + \nu + \gamma$) is recalculated in order to take into account possible effects due to the nonconservation of parity in the interaction Hamiltonian. (A.C.)

6755

KINEMATIC DEPOLARIZATION OF μ-MESONS EMITTED IN π-MESON DECAYS. J. Werle (Inst. for Nuclear Research, Warsaw). Nuovo cimento (10) 7, 255-8(1958) Jan. 16.

6756

ANGULAR DISTRIBUTION IN NEUTRAL MESON DECAY. J. E. Leiss and R. A. Schrack (National Bureau of Standards, Washington). Phys. Rev. 109, 1326-8(1958) Feb. 15.

A search has been made for an asymmetry in the decay photons from photoproduced neutral pions around the direction of motion of the pions. No asymmetry was found. This indicates that if the pions should have nonzero spin, they are not polarized or aligned in the photoproduction process. (auth)

6757

ISOTROPY OF PION EMISSION AT 6 Bev. D. T. King (Univ. of Tennessee, Knoxville). Phys. Rev. 109, 1344-6 (1958) Feb. 15.

Observations have been made of the angular distribution of energetic electron pairs in nuclear emulsions which had been exposed to the internal 6.3-Bev proton beam of the Bevatron. The method by which the pairs were found is discussed. The angular distribution of the pairs is reasonably similar to that of the neutral pions originating in proton-nucleus collisions in the emulsion. Examination of the angular distributions in terms of multiple meson production in nucleon-nucleon collisions indicates that for these observations the emission is consistent with isotropy in the center-of-mass system. (auth)

6758

MEASUREMENT OF THE TOTAL ABSORPTION COEFFICIENT OF LONG-LIVED NEUTRAL K PARTICLES. W. K. H. Panofsky (Stanford Univ., Calif. and Brookhaven National Lab., Upton, N. Y.), V. L. Fitch and R. M. Motley (Princeton Univ., N. J. and Brookhaven National Lab., Upton, N. Y.), and W. G. Chesnut (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 109, 1353-7(1958) Feb. 15.

Long-lived neutral K particles have been detected electronically and their total absorption cross section in copper has been measured in good geometry. The observed value of $\sigma = 1.12 \pm 0.25$ barns is compared with the corresponding values for charged-K-particle cross sections. (auth)

6759

ELECTROMAGNETIC INTERACTION OF THE NEUTRAL K MESON. G. Feinberg (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 109, 1381-4(1958) Feb. 15.

The electromagnetic interaction of a spinless neutral particle, which is different from its antiparticle, is discussed. It is shown that while such particles cannot emit a free photon, or be scattered by an electromagnetic field, their extended charge distribution will undergo a contact interaction with charged particles. The case of the neutral K meson (K^0) is considered as an example. The charge distribution arises from virtual dissociation into charged baryons. One contribution to the interaction is calculated. The interaction leads to a scattering of K^0's by charged particles. The form of this scattering is quite similar to that of the nuclear scattering of the K mesons, while its magnitude is much less, which implies that it will be difficult to detect. Possible other means of detecting the interaction are discussed. (auth)

6760

DECAY OF THE π MESON AND A UNIVERSAL FERMI INTERACTION. Kerson Huang and F. E. Low (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 109, 1400-2(1958) Feb. 15.

Pions rarely decay into electrons, with or without the emission of a gamma ray. Experimental upper limits for the frequencies of such decay modes as compared to the more usual $\pi-\mu$ decay are (1) $O = (\pi \rightarrow e + \nu)/(\pi \rightarrow \mu + \nu) < 10^{-5}$ and (2) $P\gamma = (\pi \rightarrow e + \gamma + \nu)/(\pi \rightarrow \mu + \nu) < 10^{-3}$. Based upon the values of the coupling constants in nuclear β decay as accepted a few years ago, various workers have expressed the belief that the smallness of (1) and (2) cannot be understood in terms of a universal Fermi interaction. The purpose of this note is to point out that this belief is no longer necessary in the light of recent experiments in nuclear β decay. (A.C.)

6761

ENERGY SPECTRUM OF γ-QUANTA FROM THE DECAY OF π^0-MESONS PRODUCED BY 660 Mev PROTONS ON HYDROGEN NUCLEI. Iu. D. Baikov and A. A. Tyapkin (Joint Inst. for Nuclear Studies). Soviet Phys. JETP 5, 779-81(1957) Dec.

The energy spectrum of γ quanta from the decay of π^0 mesons produced by 660-Mev protons on hydrogen nuclei has been measured. The angular and energy distribution of π^0 mesons produced in p–p collisions has been obtained by analyzing the γ-quantum spectrum. (auth)

6762

RESONANT PION-NUCLEON INTERACTION AND PRODUCTION OF PIONS BY NUCLEONS. L. M. Soroko. Soviet Phys. JETP 5, 927-32(1957) Dec.

The production of pions by nucleons is studied in an attempt to take approximate account of the strong pion-nucleon interaction. The calculation is based on the assumption that the probability of the process $N + N \rightarrow \pi + N + N'$ is determined by the energy of the created pion relative to one of the nucleons. Using experimental values for the matrix elements of the pion-nucleon interaction, we calculate the spectrum of pions and nucleons in the reaction $N + N \rightarrow \pi + N + N'$, and also the intensity of pion emission as a function of the angle between pion and nucleon. The results are compared with experiment. (auth)

6763

RELATION BETWEEN SCATTERING AND MULTIPLE PARTICLE PRODUCTION. S. Z. Belen'kii (P. N. Lebedev Inst. of Physics, Academy of Sciences, USSR). Soviet Phys. JETP 5, 952-6(1957) Dec.

According to Fermi's theory, the multiple production of particles in high-energy collisions should be determined by the statistical weight of the respective states. The statistical weight is calculated while taking into account the mutual interaction of pairs of particles, and it is shown that in this case the phase shift of the interacting particles is involved as a characteristic of the interaction. In resonance scattering, the effect of the scattering reduces to the appearance of an intermediate isobaric state which should be included in the statistical theory. (auth)

Microwaves

6764 AERE-G/M-98
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
EXPERIMENTS ON COUPLED HELICES. R. Kompfner. Sept. 3, 1951. 9p.

In connection with projected experiments on a new type of amplification mechanism of space charge waves in electron beams it was desired to have means of coupling into a helix through the glass envelope containing it in such a way that the point at which the energy transfer effectively takes place could be shifted along the helix in an axial direction, and furthermore, a wave coupled into the helix by such a device should, preferentially, be propagated along the helix in one direction only. An experiment devised to find explicit expressions of the length of coupling between two coaxial helices in which all the power originally in one helix is transferred to the other is described. It is shown that such a coupling device is feasible in principle. The more obvious applications of the device are discussed. (M.H.R.)

Molecular Properties

6765 AEC-tr-2392
DIFFRACTION OF MOLECULES. D. Blokhintsev. Translated from Zhur. Eksptl'. i Teoret. Fiz. 8, 1249-54(1938). 11p.

It is shown that, during the diffraction of molecules on the surface of a crystal, translational energy can change into rotational energy. Since the total energy, moreover, remains unchanged, this unique diffraction is coherent. Diffraction with the indicated transformation of energy is not very likely for symmetrical molecules (H_2, D_2) but it assumes great significance for unsymmetrical molecules (HD). The direction of the diffracted bundle formed by the rotating molecules is subject to the ordinary conditions of diffraction on a plane lattice, with the only difference that the wavelength of the diffracted bundle is greater than the wavelength of the incident bundle. The problem which remains to be solved consists of calculating the diffraction of the dumbbell molecule on the crystalline lattice. (auth)

Neutrons

6766 AFOSR-TN-58-123
Stanford Univ., Calif.
ELECTROMAGNETIC STRUCTURE OF THE NEUTRON. Technical Report No. 25. L. I. Schiff. Feb. 1958. 16p. Project No. 3750-37504. Contract AF18(600)-545. (AD-152150).

Recent experiments on elastic and inelastic electron-deuteron scattering, with their theoretical interpretations, are considered in the light of a possible nonvanishing electric charge distribution of the neutron. The most likely conclusion is that the neutron charge density is zero and the neutron anomalous magnetic moment density is like that of the proton. (auth)

6767 KAPL-M-RM-1
Knolls Atomic Power Lab., Schenectady, N. Y.
THE AGE OF NEUTRONS IN WATER FROM AN ANISOTROPIC SHELL SOURCE. C. Raymond Mullin. Feb. 25, 1958. 14p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

An experiment was performed at Hanford to determine the age of 1-Mev neutrons in water by using a ball of radioactive Na. Analysis of the experiment was made to show that the age from a "shell" source can be expressed as the age from a point source plus a small correction factor. (auth)

6768
ON THE PRINCIPLE OF INVARIANT IMBEDDING AND NEUTRON TRANSPORT THEORY. I. ONE-DIMENSIONAL CASE. Richard Bellman, Robert Kalaba, and G. Milton Wing (Rand Corp., Santa Monica, Calif. and Los Alamos Scientific Lab., N. Mex.). J. Math. and Mech. 7, No. 2, 149-62(1958) Mar.

Some previously presented techniques are developed in detail. A one-dimensional version of the reflection and transmission of neutrons, and the phenomenon of critical mass are considered. The effects of fission, capture and forward and backward scattering are considered, but collisions between neutrons are not. Some numerical results describing the distribution of reflected and transmitted neutrons in the neighborhood of critical mass obtained from the solution of forty simultaneous nonlinear differential equations are presented. (M.H.R.)

6769
NEUTRON PROPAGATION IN A PERFECT THIN CRYSTAL. André Herpin (Nuclear Research Center, Saclay, France). J. phys. radium 18, 649-55(1957) Dec. (In French)

Studies were made of diffraction of neutrons in thin crystals. Equations are developed for rigorous propagation of coherent neutron beams. These equations can be applied as a basis in studies of wave extinction. Optic waves, potential neutron-nucleus interactions, the equation for propagation of optic waves, and the solution of the propagation equation are discussed, as well as the propagation in a thin crystal. In the appendix are included investigations on the influence of thermal agitation on the propagation of neutrons. (R.V.J.)

6770
CORRECTION OF DIFFUSION DURING THE MEASUREMENT OF TOTAL CROSS SECTIONS FOR FAST NEUTRONS. J. F. Vervier (Centre de Physique Nucléaire de l'Université de Louvain, Belgium). Nuclear Instr. 2, 53-60(1958) Jan. (In French)

A general formula is given for the calculation of the in-scattering correction which is to be applied to the total cross section for fast neutrons, as measured by transmission experiments. It is shown that inelastic scattering and (n, 2n) reactions are negligible for this evaluation: only elastic scattering is to be taken into account. This influence can be estimated by comparison with some experimental results or by application of the diffraction theory of neutron scattering using, as nuclear radius, $R = r_0 A^{1/3}$ where $r_0 = 1.25 \times 10^{-13}$ cm; the maximum error involved in this evaluation is ± 20%. (auth)

Nuclear Physics

6771 HW-53492
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
NUCLEAR PHYSICS RESEARCH QUARTERLY REPORT [FOR] JULY, AUGUST, SEPTEMBER 1957. Nov. 6, 1957. 36p. Contract W-31-109-Eng-52. $1.00(OTS).

Theoretical work on thermal neutron flux in a nonabsorbing heavy gas medium with a temperature discontinuity and the reactivity of homogeneous systems of U of all enrichments is summarized. The variation in the U^{235} fission cross section with incident neutron energy was measured. The Pu^{241} fission cross section was measured over the energy interval 0.025 to 1.0 ev using the crystal diffraction

spectrometer. Results are included on measurements of k_∞ for D_2O moderated clusters of UO_2 and Pu–Al rods and for homogeneous mixtures of enriched UO_2 and H_2O. (For preceding period see HW-51983.) (M.H.R.)

6772 INS-PT-1

Kyoto Univ. Research Inst. for Fundamental Physics and Tokyo Univ. Inst. for Nuclear Study.

ANTINUCLEON-NUCLEON INTERACTIONS. Ziro Koba and Gyo Takeda. [1957]. 28p.

The nucleon or antinucleon is regarded as having a compound structure, with its core in the center and a pion cloud in the outer part. When the distance between the nucleon and the antinucleon is larger than the core radius, a potential acts between them due to pion exchange. A simple version of this model is adopted, which is essentially equal to the Feshbach-Weisskopf treatment in the theory of nuclear reactions. It is shown that the elastic scattering cross section can be made much smaller than the annihilation cross section. The static pion theory is applied to the clouds and the statistical theory to the core annihilation. Thus, it is shown that pion multiplicity and composition, which are comparable with the experimental ones, can be obtained. (M.H.R.)

6773

THE CROSS SECTION OF INELASTIC PROTON-PROTON INTERACTION AT PROTON ENERGIES OVER 7 BEV. K. I. Alekseeva and N. L. Grigorov (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 117, 593-6 (1957) Dec. 1.

The cross sections of inelastic proton-proton interactions at proton energies of ~ 20 Bev were measured in the stratosphere at elevations of 20 to 25 km and 31°N lattitude. Determination of the p-p interaction cross section was made by evaluating the variations in the shower formation in lead and by direct measurement of the number of electron showers in graphite and paraffin. The magnitude 32 ± 10 mb was obtained for ~ 20 Bev protons. The inelastic p-p interaction cross section did not increase much in the interval of 1.5 to 2.0 and up to ~ 20 Bev. (R.V.J.)

6774

QUADRUPOLE MOMENTS OF NUCLEI. A. N. Kushnirenko (Shevchenko Kiev State Univ.). Doklady Akad. Nauk S.S.S.R. 117, 963-4(1957) Dec. 21. (In Russian)

Electric quadrupole moments were studied within the limits of the nuclear shell model. The nuclear wave function was represented as the linear combination of Slater functions composed of single-nucleon wave functions. Tables are presented of the electric quadrupole moments for some light nuclei without taking into account the configurations. The formulas with mixed configurations showed an additional electric quadrupole moment. It has been assumed that the complex shell configurations are, at least, partially responsible for the abnormally large positive electric quadrupole moment in some nuclei with $Z > 50$. (R.V.J.)

6775

AN INTRODUCTION TO THE PHYSICS OF THE NEW PARTICLES. C. Franzinetti and G. Morpurgo. Nuovo cimento (10) 6, Suppl. No. 2, 469-802(1957).

An account is given of the basic properties (decay modes, mass, mean life, etc.) of the K mesons and hyperons, and of the experiments which lead to the determination of these properties. An account is included of the attempts which were made to interpret the behavior of the new particles: the paradox strong production-slow decay, the introduction of the strangeness, the $K^+_{\pi 2}$, $K_{\pi 3}$ problem, and the two neutral boson components. The attempts to classify the new particles based on postulating invariance under rotations in a four dimensional isotopic spin space are only mentioned. A survey of the interaction properties of the new particles with the old ones is presented; that is: associated production in H and in complex nuclei, interaction of K^+ and K^-, and hyperfragments. The experimental results of the Brookhaven and Berkeley bubble chamber groups and the results of the Brussels, Milan, Padia groups are reported. The experimental results which confirmed nonconservation of parity in weak interactions are included, together with some theoretical results. The theoretical consequences for the neutral bosons are summarized. (M.H.R.)

6776

FLUCTUATIONS OF TRACK PARAMETERS IN NUCLEAR EMULSIONS. B. J. O'Brien (Univ. of Sydney). Nuovo cimento (10) 7, 147-62(1958) Jan. 16.

The fluctuations in nuclear-emulsion track parameters have been studied in a G5 emulsion of low minimum grain density by measurements of the blob density and integral gap length of long tracks of relativistic heavy nuclei. The intrinsic variations arising from the statistical nature of the process of track formation were found to be in good agreement with those predicted by the Blatt fluctuation theory. Subjective, emulsion, and other variations were found in some cases to be comparable to the intrinsic variations. A method of estimating these fluctuation effects in any general experimental measurement is given. (auth)

6777

ON THE THEORY OF THE NEUTRINO WITH ORIENTED SPIN. A. Sokolov (State Univ., Moscow). Nuovo cimento (10) 7, 240-3(1958) Jan. 16.

6778

ELECTRIC-MONOPOLE DIRECTIONAL-CORRELATION EXPERIMENTS. E. L. Church (Frankford Arsenal, Philadelphia), M. E. Rose (Oak Ridge National Lab., Tenn.), and J. Weneser (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 109, 1299-1306(1958) Feb. 15.

Angular-correlation experiments involving conversion electrons are sensitive to a small admixture of electric-monopole (E0) transitions. The coefficient of $P_2(\cos\theta)$ in the correlation function involving a mixed E0 + M1 + E2 transition contains an interference term between the E0 and E2 electrons, which is proportional to the ratio of the E0 and E2 matrix elements. Measurement of this coefficient provides a sensitive means for determining both the magnitude of the monopole matrix element and its phase relative to the E2 gamma-ray matrix element. The effect on the directional-correlation function between such K-conversion electrons and a coincident gamma ray is calculated explicitly. Specific numerical results are given for Pt ($Z = 78$) over a range of energies, and the feasibility of the method is illustrated with reference to the particular case of the $2+ \rightarrow 2+ \rightarrow 0+$ cascade in Pt^{196}. (auth)

6779

RELATIVISTIC THEORY OF RADIATIVE ORBITAL ELECTRON CAPTURE. P. C. Martin and R. J. Glauber (Harvard Univ., Cambridge, Mass.). Phys. Rev. 109, 1307-25(1958) Feb. 15.

A fully relativistic treatment of the radiation accompanying nuclear capture of orbital electrons is presented. All effects of the electrostatic field surrounding the nucleus are taken into account. As a preliminary step, convenient representations for the electron Green's function and initial state wave function in a Coulomb field are derived. These forms, involving Dirac operators applied to scalar functions and free-particle angular eigenfunctions, are developed from the second-order Dirac equation. They are particularly useful for calculations since the procedures which make use of the properties of traces can be employed with them. With the aid of these representations the photon energy spectrum and polarization associated with allowed

radiative K capture are computed. Relativistic Coulomb corrections are shown to decrease the expected photon intensity significantly at all energies. Since their effect is not sensitively dependent on energy, the predicted shape of the spectrum is not greatly altered. The Coulomb field also influences the degree of polarization of the photons emitted, but has an appreciable effect only near the lower end of the spectrum. The influence of atomic screening on the capture from the K and L shells is also taken into account approximately. It is shown that screening considerably decreases the likelihood of radiative capture of all but the innermost electrons. Finally, the existing experimental evidence is reviewed and shown to agree with the theory presented. Some additional experimental tests are proposed. (auth)

6780

PRODUCTION OF STRANGE PARTICLES BY $\pi^- - p$ INTERACTIONS NEAR THRESHOLD. L. B. Leipuner and R. K. Adair (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 109, 1358-63(1958) Feb. 15.

Observations have been made, in a liquid hydrogen bubble chamber, of the production and decay of strange particles produced by the interaction of 960-Mev π^- mesons with protons. The total strange particle production cross section was measured to be 1.02 ± 0.20 millibarns. The cross section is 0.58 ± 0.12 millibarn for $\Lambda^0 - \theta^0$ production, 0.35 ± 0.09 millibarn for $\Sigma^0 - K^+$ production, and is 0.09 ± 0.04 millibarn for $\Sigma^- - K^+$ particles. Production angular distribution was peaked somewhat backwards for Σ^0 and Λ^0 hyperons. These cross sections, together with other data, are interpreted as indicating the existence of a very strong interaction for the production of strange particles which extends over a small radius. The decay products of the Λ^0 hyperons from $\Lambda^0 - \theta^0$ production were preferentially aligned with the incoming beam, a result suggesting a spin of $\frac{1}{2}$ for the Λ^0. Decay distributions for Λ^0 particles resulting from Σ^0 decay, and for θ^0 mesons, were consistent with isotropy. (auth)

6781

NUCLEON-ANTINUCLEON INTERACTION AT INTERMEDIATE ENERGIES. James S. Ball and Geoffrey F. Chew (Univ. of California, Berkeley). Phys. Rev. 109, 1385-91(1958) Feb. 15.

The Yukawa interaction between nucleon and antinucleon is investigated in the intermediate energy range (50 to 200 Mev) where it is shown that the details of the short-range forces are unimportant; that is, cross sections are primarily determined by the pion exchange potential for distances greater than 10^{-13} cm. Numerical calculations by the WKB method, using two possible forms of the potential, give nucleon-antinucleon cross sections several times larger than the nucleon-nucleon cross sections at corresponding energies. This large difference is due to systematic cancellation effects in the nucleon-nucleon interaction which are removed in the nucleon-antinucleon system. It is shown that irregularities in the annihilation cross section as a function of energy are to be expected as a result of the sudden onset of individual partial waves. (auth)

6782

CONSERVATION LAWS FOR LEPTON PROCESSES. Michiji Konuma, Seitaro Nakamura, and Hiroomi Umezawa (Tokyo Univ., Japan). Phys. Rev. 109, 1404-6(1958) Feb. 15.

6783

REACTIONS INVOLVING POLARIZED PARTICLES. M. I. Shirokov (Academy of Sciences, USSR). Soviet Phys. JETP 5, 835-46(1957) Dec.

The statistical tensors of particles produced in reactions of the types $a + b \rightarrow c + d$ and $a \rightarrow c + d$ have been obtained in the most general case, when the incident beam and the target particles are in definite spin states. New selection rules are deduced which supplement the previous general selection rules. The first of these rules can be regarded as a generalization of the rule according to which the polarization vector of the particles produced in the reaction is perpendicular to the plane of the reaction if the incident and target particles are unpolarized. The second rule states that the statistical tensor of a particle produced in the reaction, defined relative to the direction of its momentum, is either purely real or purely imaginary if the incident and target particles are unpolarized. As a particular case, the decay of an unstable particle into particles of spins $\frac{1}{2}$ and 0 is considered, and it is shown that the polarization and angular distribution of these particles depend only on the spin and spin state of the decaying particle. (auth)

6784

MODEL OF A SEMI-TRANSPARENT NUCLEUS WITH A DIFFUSE BOUNDARY, II. P. E. Nemirovskii. Soviet Phys. JETP 5, 932-7(1957) Dec.

A new method is presented for calculating nuclear interaction cross sections for low energy neutrons. Assuming that no absorption occurs in the surface layer, it is shown that the energy dependence of the cross section at low energy is the same for a potential with diffuse boundary as for a rectangular well. The capture cross section is larger for the diffuse than for the sharp boundary. Values of the parameters and of the nuclear potential are in satisfactory agreement with the experiment over a wide range of nuclear weights and energies. (auth)

6785

REDUCTION OF THE TWO-NUCLEON PROBLEM TO A SINGLE-NUCLEON PROBLEM IN THE NONRELATIVISTIC RANGE. Yu. V. Novozhilov (Leningrad State Univ.). Soviet Phys. JETP 5, 1030-2(1957) Dec.

Interactions between two nucleons at a fixed point are considered, and an attempt is made to express renormalized two-nucleon matrix elements in terms of renormalized single-nucleon matrix elements. (R.V.J.)

6786

NUCLEAR STRIPPING REACTIONS. S. T. Butler and O. H. Hittmair. Sydney, Horwitz Publications, Inc. and New York, John Wiley & Sons, Inc., 1957. 137p.

The concept of direct reaction is introduced, the various types of direct reactions are discussed, and the salient features of these reactions are derived by simple semi-classical arguments. Most of the book has to do with the deuteron stripping reaction. Discussions are included on: the cross section in the simple and in the nuclear case, corrections to the stripping approximations, Coulomb corrections, nuclear corrections, reduced widths, angular correlations, the polarization of outgoing particles, and the boundary matching and matrix formulation methods of deriving the stripping cross section. Direct reactions related to the deuteron stripping reactions are discussed, including the deuteron pick-up reaction, and stripping and pick-up reactions involving the triton or He^3. Finally, the surface reaction is dealt with. (M.H.R.)

Nuclear Properties

6787 AERE-T/R-2389

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

NUCLEAR DATA SERIES. PART I. J. S. Story. 1957.

Date of MS. Apr. 1953. Decl. with amendment Apr. 1957. 28p. $0,72(BIS).

Declassified version of AERE-T/M-77. Part II issued as AERE-T/M-97.

Thermal neutron cross sections are presented for U^{233}, U^{235}, U^{238}, Pu^{239}, and the standards on which the measurements are based. (C.H.)

6788 CWR-400-1

Curtiss-Wright Corp. Research Div., Quehanna, Penna. MAXWELL-BOLTZMANN AVERAGED NEUTRON CROSS SECTIONS. W. J. Roberts. Sept. 30, 1957. 18p. Contract AT(30-3)-220. $3.30(ph OTS); $2.40(mf OTS).

The thermal fission and absorption cross sections of many of the non 1/v elements of interest to reactor application were averaged over a Maxwell–Boltzmann spectrum of neutron energies. The averaging process was done using a code developed for the IBM 704. The formula used was: $\langle\sigma(E_T)\rangle = \int_0^\infty \sigma(E)\, E\exp(-E/E_T)\, dE / \int_0^\infty E \exp(-E/E_T)\, dE$ where $\langle\sigma(E_T)\rangle$ = thermal averaged cross section at thermal energy E_T, E_T = mean spectrum energy, and $\sigma(E)$ = point value of cross section at energy E. The values of E_T chosen for computation were arbitrary and selected only to cover the 0.0253ev–0.24ev range representatively. The $\sigma(E)$ values are from BNL-325. The elements are listed alphabetically. The results are tabulated in columnar form. (auth)

6789

THE STUDY OF NUCLEAR COLLECTIVE MOTION BY STRIPPING REACTIONS. G. R. Satchler (Univ. of Michigan, Ann Arbor). Annals of Physics 3, 275-91(1958) Mar.

The 'intrinsic' probability for capture of nucleons is studied for nuclei which exhibit collective vibrations or rotations in addition to an underlying shell structure of independent nucleon orbits. Such probabilities or reduced widths for low-lying nuclear levels can be measured in 'direct' nuclear reactions; the present discussion is formulated chiefly in terms of deuteron stripping. Various selection rules are derived, and possible reasons for their breakdown studied. It is found that stripping is a particularly direct way of studying the wave functions of single particle orbits in strongly deformed nuclei. There are simple branching ratios between the capture probabilities into the various members of a rotational band in such nuclei. Finally, it is shown how such reduced width measurements can provide an independent check on the wave functions postualted by Osborn and Klema to correlate empirically the ground state properties of nuclei. (auth)

6790

NEW STUDY ON THE LOW LEVELS OF Be^8. J. Catalá, R. Font, J. Aguilar, F. Senent, and M. de la Cuadra (Instituto de Optica «Daza de Valdés», Valencia (City)). Anales real soc. espan. fis. y quim. (Madrid) Ser. A. 50, 229-34 (1957) Nov.-Dec. (In Spanish)

Nuclear emulsions were used in a study of the neutrons produced in the disintegration of Li^7 by deuterons. The energy levels of Be^8 reported previously were confirmed, and the existence of two levels at 5.61 and 6.68 Mev was indicated. (J.S.R.)

6791

AN INTERPRETATION OF THE LOW-LYING EXCITED STATES OF Mg^{25} AND Al^{25}. A. E. Litherland, H. McManus, E. B. Paul, D. A. Bromley, and H. E. Gove (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Can. J. Phys. 36, 378-404(1958) Mar.

A description of the experimental results obtained for Mg^{25} and Al^{25} is given based upon the assumption that the excited nuclear states are rotational states. In Mg^{25} and Al^{25} members of four rotational bands can be identified. The band based on the ground state can be assigned K = 5/2 while the three excited-state bands, two positive parity and one negative parity, can be assigned K = 1/2. The dipole γ-ray transitions between the K = 1/2 bands and the ground state K = 5/2 band are forbidden on the rotational model and it is a salient feature of the γ-ray cascading in Mg^{25} and Al^{25} that the ground-state transitions are always amongst the weakest transitions from excited states assigned to K = 1/2 bands. Besides giving a quantitative account of the γ-ray decay of the excited states the rotational model also predicts the number and type of the bands observed. The experimental values of the $Mg^{24}(d, p)Mg^{25}$ deuteron stripping reduced widths can also be approximately predicted by the model. (auth)

6792

PILE NEUTRON ABSORPTION CROSS-SECTION OF ^{83}Kr, ^{131}I AND ^{133}Xe. T. J. Kennett and H. G. Thode (McMaster Univ., Hamilton, Ont., Can.). J. Inorg. & Nuclear Chem. 5, 253-8(1958).

The pile neutron absorption cross sections of the fission products Kr^{83}, I^{131}, and Xe^{133} have been determined using mass spectrometric techniques. The values were found to be be 216 ± 43 barns, 51 ± 40 barns, and 188 ± 89 barns for Kr^{83}, I^{131}, and Xe^{133}, respectively. (auth)

6793

THE CROSS-SECTION OF THE REACTION $^{134}Cs(n\gamma)^{135}Cs$ AND THE HALF-LIFE OF ^{134}Cs. J. G. Bayly and F. Brown (Atomic Energy of Canada Ltd., Chalk River, Ont.) and G. R. Hall and A. J. Walter (Atomic Energy Research Establishment, Harwell, Didcot, Berks, Eng.). J. Inorg. & Nuclear Chem. 5, 259-63(1958).

The isotopic composition of Cs samples which had been subject to intense reactor neutron irradiation was measured with a 6 in. radius, 60° sector field, mass spectrometer fitted with a triple filament thermal ionization source. The cross section of the reaction $Cs^{134}(n\gamma)Cs^{135}$ was calculated from the observed isotopic composition and found to be 134 ± 12 barns. By measuring the change with time of the $Cs^{134}/Cs^{133} + Cs^{135}$ ratio using the mass spectrometer the half life of Cs^{134} was found to be $2.15 \pm {}^{0.08}_{0.04}$ years. In a subsidiary experiment the cross section of the reaction $Cs^{133}(n\gamma)Cs^{134}$ was found by activation to be 30.4 ± 1.7 barns. (auth)

6794

SPECTRUM OF THE INTERNAL BREMSSTRAHLUNG AND THE AUTO-IONIZATION LINES OF Y^{90} AND P^{32} NUCLIDES IN THE REGION OF LOW ENERGIES. Gerard-André Renard (College of France, Paris). J. phys. radium 18, 681-6(1957) Dec.

6795

X-RAY PHOTOEXCITATION OF Li^7. Olof Beckman and Roland Sandström (Inst. of Physics, Uppsala). Nuclear Phys. 5, 595-602(1958) Mar.

The level width and lifetime of the 477-kev level in Li^7 have been measured by photoexcitation using the continuous radiation from an x-ray tube. The level width has been calculated from an absolute measurement of the scattered radiation in an angle of 120 degrees and from a self-absorption experiment. The measured level width is $\Gamma = 6.2 \times 10^{-3}$ ev giving the lifetime $\tau = (1.1 \pm 0.3) \times 10^{-13}$ sec. The result is in agreement with earlier measurements by means of the Doppler-broadening of the gamma-line following the reaction $B^{10}(n\alpha)Li^7$. (auth)

6796

THE 2.85 kev NEUTRON RESONANCE OF SODIUM. J. E. Lynn, F. W. K. Firk, and M. C. Moxon (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Phys. 5, 603-14(1957) Mar.

The measurement of the total neutron cross section of sodium in the region 600 to 15 kev using the Harwell 15-

Mev linear electron accelerator is described. Analysis of the results in conjunction with the known values of the low energy elastic and radiative capture cross sections leads to the following conclusions. The cross section up to 15 kev may be described in terms of a potential scattering cross section of 2.4 barn and two s-wave resonances, one at 2.85 ± 0.04 kev neutron energy and the other at negative energy. The 2.85 kev, resonance has parameters $\sigma_0 = 370 \pm 5$ barn, $\Gamma_n = 405 \pm 12$ ev, $\Gamma_\gamma \leq 0.34 \pm 0.01$ ev and spin J = 1+. The negative energy resonance has a ratio of reduced width to resonance energy of $\gamma_n^2/E_R = -0.5$ while $|E_R| \gg 1$ kev. The spin of this resonance is J = 2+. (auth)

6797

ON ANOMALOUS CONVERSION COEFFICIENTS OF DIPOLE TRANSITIONS. Sven Gösta Nilsson and John O. Rasmussen (Univ. of California, Berkeley). Nuclear Phys. 5, 617-46(1958) Mar.

General aspects of the problem of anomalous nuclear-structure-dependent contributions to the internal-conversion process are considered in conjunction with highly retarded electric or magnetic dipole transitions. Formulas for an elementary theory of anomalous internal conversion for E1 transitions are given. Selection rules for the relevant nuclear matrix elements are given in the quantum numbers appropriate to spheroidally deformed nuclei (K, N, n_z, Λ, Σ). Similar selection rules for M1 transitions are given on the basis of the anomalous operators previously derived by Church and Weneser. The experimental data on dipole conversion coefficients of retarded transitions for odd-mass spheroidal nuclei are surveyed. It is noted that where retardation is ascribable to K-forbiddenness (up to retardation from the single-proton rate by a factor of 10^9) no detectable anomalies are found, but where transitions are allowed by K-selection rules detectable conversion-coefficient anomalies may generally be found at retardations greater than 10^5 to 10^6 and are not found at lesser retardation. There are some exceptions to this general rule, though. From the present meager data the utility of selection rules in the asymptotic quantum numbers, N, n_z, Λ and Σ, for anomalous-conversion matrix elements may be open to question, although their utility in qualitatively explaining retardation of the radiative transitions is very evident. The simple E1 theory is applied in an attempt to explain quantitatively the very anomalous 85-kev transition in Pa^{231}. Values of the two parameters in the simple theoretical expressions can be found to explain all three L- subshell conversion coefficients. The magnitude of one parameter, the nuclear matrix element $\langle r^3 Y_1 \rangle$, is consistent with estimates from the single-particle model. However, the magnitude required of the other parameter is such as to suggest that in the intranuclear process terms of higher order in the electromagnetic field than treated here may be of importance. (auth)

6798

THERMAL-NEUTRON DATA FOR THE ELEMENTS. M. V. Davis and D. T. Hauser (General Electric Co., Richland, Wash.). Nucleonics 16, No. 3, 87-9(1958) Mar.

A compilation of new data is given on the scattering angle, average logarithmic energy decrement, microscopic and macroscopic absorption, scattering, and total cross sections, mean free path, resonance integral, diffusion length, and diffusion coefficient for all the elements from 1 to 101 for thermal neutrons. (J.S.R.)

6799

NUCLEAR MOMENTS OF INERTIA. H. M. Foley (Inst. of Theoretical Physics, Copenhagen). Nuovo cimento (10) 7, 244-5(1958) Jan. 16.

6800

PROPERTIES OF NUCLEAR MATTER. K. A. Brueckner (Univ. of Pennsylvania, Philadelphia) and J. L. Gammel (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 109, 1023-39(1958) Feb. 15.

The properties of nuclear matter have been determined by the solution of the nuclear many-body problem, using the reaction matrix theory of Brueckner. The nonlinear integral equations characteristic of the theory have been solved with the aid of the fast electronic computer IBM 704. The two-body interaction assumed is the phenomenological potential of Gammel, Christian, and Thaler. It is found that the binding energy of nuclear matter, neglecting Coulomb forces, is 14.6 Mev per particle at a density corresponding to a radius parameter $r_0 = 1.00 \times 10^{-13}$ cm. The Coulomb repulsion in a heavy nucleus is shown to drop the density by approximately 15%. The tensor force is shown to give approximately 6-Mev binding energy. The results are found to be very sensitive to the self-consistency requirements of the theory, the binding energy shifting from 14.6 Mev to 34.4 Mev if the velocity dependence of the single-particle potential is neglected. The actual solutions were made self-consistent by an iteration procedure which converged in five or six iterations, the final results being self-consistent to one part in 10^5 or 10^6. The effective mass for nucleon motion in the Fermi sea is found to vary from 0.56M for slow particles to 0.66M for particles near the Fermi surface. This velocity dependence of the potential is closely related to the symmetry energy which also depends, however, on the shifting in the spin populations as the neutron-proton ratio is changed from unity. The symmetry energy computed is 10 to 15% larger than that deduced from experiment. (auth)

6801

ELECTRIC MONOPOLE TRANSITIONS IN Ge^{70} AND Zr^{90}. David E. Alburger (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 109, 1222-9(1958) Feb. 15.

The electric monopole crossover transition from the 1.215 Mev 0+ second excited state to the ground state of Ge^{70} has been observed with an intermediate-image beta-ray spectrometer arranged for electron-electron coincidence measurements. Internal conversion electrons in delayed coincidence with Ga^{70} beta rays correspond to a 1.215-Mev transition intensity of 0.0025% per disintegration. Total beta-ray branching to the 1.215-Mev state is 0.18%, mostly followed by a (0.173 ± 0.002)−(1.042 ± 0.005) Mev gamma-ray cascade through the first excited state. Beta-ray branching to the 1.042-Mev level in Ge^{70} is 0.30%. Beta-conversion-electron delayed coincidence measurements taken at the peak of the 0.173-Mev K-line give a half-life value of $(3.0 \pm 0.5) \times 10^{-9}$ sec for the 1.215-Mev state. It follows that the partial half-life for K-conversion of the 0−0 transition is $(2.4 \pm 1.2) \times 10^{-7}$ sec which compares with 1.6×10^{-7} sec expected if the matrix element were the same as for the 0−0 transition in Ge^{72}. Using similar techniques on Y^{90} the half-life of the 1.75 Mev 0−0 transition in Zr^{90} has been found to be $(6 \pm 1.5) \times 10^{-9}$ sec. (auth)

6802

PROPERTIES OF s-WAVE AND p-WAVE NEUTRON RESONANCES IN NIOBIUM. A. Saplakoglu, L. M. Bollinger, and R. E. Coté (Argonne National Lab., Lemont, Ill.). Phys. Rev. 109, 1258-62(1958) Feb. 15.

The neutron resonances of niobium were studied with the Argonne fast chopper. The transmission of a series of four samples was measured over the range of energy from 10 to 10,000 ev. Resonance parameters were deduced for thirteen levels, those below 700 ev. An examination of these parameters, calculations with the optical model, and a

comparison of the cross sections at low and high energy all indicate that some of the resonances, even those below 100 ev, are due to a p-wave process. By using this evidence, average parameters are deduced. The radiation width is found to be 0.22 ev. The strength function $\overline{\Gamma}_n^0/\overline{D}$ for s-wave neutrons is 0.10×10^{-4}. The value of the corresponding quantity for p-wave neutrons is 4.6×10^{-4}. The resonance absorption integral deduced from the parameters is found to be in agreement with the result of a "pile oscillator" measurement. (auth)

6803

TOTAL NEUTRON CROSS SECTIONS NEAR 14.1 Mev. Jerry P. Conner (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 109, 1268-72(1958) Feb. 15.

Total cross sections of C, Ca, Ti, Ba, La, Ce, Nd, Sm, Gd, Er, Ta, Au, and Pb for neutrons of energies between 13.1 and 15.6 Mev have been measured by the transmission technique with good geometry. The range of neutron energy was achieved by observing neutrons at various angles from thin tritium targets bombarded by deuterons of energy up to 450 kev. Geometry was such that a scattering in the sample of more than about 2° removed the neutron from the beam to the stilbene scintillation detector. The total cross section of carbon for neutrons was found to vary from 1.41 barns at 13.1 Mev to a minimum of 1.31 barns at 14.2 Mev to 1.49 barns at 15.6 Mev. Other elements showed smaller cross-section variation with energy. (auth)

6804

MASS ASSIGNMENTS OF 23-sec Pd^{107m} and 4.8-min Pd^{109m}; SEARCH FOR <3-sec Pd^{105m}. U. Schindewolf (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 109, 1280-1(1958) Feb. 15.

The formation of the 23-sec and 4.8-min Pd isomers by neutron activation of Pd^{106} and Pd^{108} samples leads to the mass assignments 23-sec Pd^{107m} and 4.8-min Pd^{109m} Both isomers decay by isomeric transition with considerable conversion only and are not formed in the β decay of the corresponding Rh isotopes. The spin assignments (11/2−) could be confirmed. No isomeric state of Pd^{105} was found, and it is concluded that its half-life will be shorter than 3 sec. (auth)

6805

THE ABSORPTION OF HIGH-ENERGY PHOTONS IN MATTER. J. Moffatt, J. J. Thresher, G. C. Weeks, and R. Wilson (Univ. of Oxford). Proc. Roy. Soc. (London) A244, 245-58(1958) Mar. 11.

Total absorption cross sections of hydrogen, carbon, copper, silver, lead, and uranium have been measured for photons of mean energy 94 Mev. The method was to measure the transmission through an absorber of photons from the Oxford synchrotron, using a biased liquid scintillation counter to select photons of energy near the peak energy of the machine. The experimental data for hydrogen have been used to deduce a value for the cross section for pair production in the field of the electron of 4.7 ± 0.4 mb. The relative cross sections for the heavier elements have been determined to better than ± 0.2%, and confirm the most recent calculations of the correction to the Born approximation in the theory of pair production. (auth)

6806

REMARKS ON COULOMB EXCITATION. Lennart Simons. Soc. Sci. Fennica, Commentationes Phys. Math. 21, No. 2. 14p. (1958).

A comparison is made between the values rendered by different theories for the reduced transition probability B(E2) for Coulomb excitation. This comparison was made between the values for substances from various parts of the periodic system and various energy levels, as well as for various bombarding particles with different energies. That B(E2) is independent of the bombarding particle and of its energy speaks in favor of the newest wave mechanical theories, as does also the ratio between the B(E2) values for the lowest rotational levels of heavy odd-A nuclei. Comparison between the values of B(E2) obtained from Coulomb excitation and those that are found from the half life of the de-excitation of the excited level seems to indicate that the sources of error are still of such magnitude as to preclude the statement of any definite results from such comparisons. (auth)

6807

NUCLEAR PHOTOEFFECT IN Be^9 AT HIGH ENERGIES. T. I. Kopaleishvili (Tbilisi State Univ.). Soviet Phys. JETP 5, 1018-19(1957) Dec.

6808

RELATIVE MEASUREMENTS OF THE POLARIZATION OF β PARTICLES FROM Tl^{204}, Au^{198}, AND $Sr^{90} + Y^{90}$. Joachim Heintze. Z. Physik 150, 134-43(1958). (In German)

A method in which the polarization of β particles can be measured by combined multiple and single scattering was developed for accurate relative measurements. The depolarization was experimentally investigated by self-scattering in the preparation. The energy dependence of the apparatus was discussed. From a comparison of the polarization of Tl^{204} and Au^{198}, the polarization of Au^{198} was calculated as $P_u = -(0.98 \pm 0.05)$ v/c when one assumes for the pure Gamow-Teller transition of Tl^{204} $P = -v/c$ ($v/c \approx 0.7$ to 0.9). The measurements were made relative to $Sr^{90} + Y^{90}$, P = 1. (tr-auth)

6809

β TRANSITION BETWEEN THE GROUND STATES OF Co^{58} AND Fe^{58}. H. Daniel. Z. Physik 150, 144-8(1958). (In German)

The β^+ spectrum of Co^{58} was investigated with a double focusing β spectrometer. A double forbidden transition between the ground states of Co^{58} and Fe^{58} was found with an intensity of approximately 6×10^{-6} per decay. (tr-auth)

Nuclear Reactors

Refer also to abstracts 6993, 7020, 7021, 7022, 7023, 7026, 7027, 7028, 7030, 7043, 7048, 7049, 7050, 7051, 7054, 7055, 7056, and 7057.

6810 AECD-3730

General Electric Co., Schenectady, N. Y.

DEMAND COMPUTER FOR PROJECT SIR. R. A. Raber. Mar. 23, 1953. Decl. Oct. 4, 1955. 45p. (TR53A0321). $7.80(ph OTS); $3.30(mf OTS).

Design is described of a demand computer, made up of two servos, which was developed to meet certain requirements for the Submarine Intermediate Reactor Project. Extra features and wide ranges of adjustment were incorporated to permit further investigation of the over-all system. The prototype was a sealed unit having external adjustments and terminals for testing. (C.H.)

6811 AECU-3645

Knolls Atomic Power Lab., Schenectady, N. Y.

A METHOD OF ANALYSIS OF REACTOR EXPLOSIONS. W. J. Levedahl and R. D. Howerton. [nd]. 29p. Contract [W-31-109-Eng-52]. $4.80(ph OTS); $2.70(mf OTS).

The containment of explosions in a nuclear power plant is an important safeguards consideration. In order to prevent radioactive contamination of the surrounding area, the reactor housing must be able to withstand the pressures and high energy fragments produced by conceivable reactor explosions. A method of analytically determining pressures, radii, and velocities of all regions of an ex-

ploding reactor is presented. The solution is obtained by numerical integration of differential equations relating rate of energy input, pressure, volume, acceleration, and velocity of several concentric shells representing the core, reflector, pressure vessel, shield water, and shield tank. Complete reactors are transformed into equivalent spheres for analysis and results are transformed back to the true configuration. An explosion due to metal-water reaction causes missile velocities only fractionally higher than velocities from an explosion due to fatigue failure at ordinary operating pressures. Shield-fragment velocities may equal or exceed pressure vessel fragment velocities in the example presented here. Core reactivity drops many dollars during the first milliseconds of an explosion, and the amount of metal-water reaction which can occur may be limited by this nuclear shutdown. (auth)

6812 APAE-18

Alco Products, Inc., Schenectady, N. Y.

INITIAL OPERATION AND TESTING OF THE ARMY PACKAGE POWER REACTOR APPR-1. J. L. Meem, ed. Aug. 9, 1957. 247p. Contract AT(11-1)-318. $5.50(OTS).

The startup and initial operation of the APPR-1 and the results of the test program on the reactor are described. The latter program began with testing of the vapor container for leaks, checking the integrity of the entire primary and secondary systems, and testing of individual components. Pre-nuclear testing of the primary system was performed. The system was operated at full temperature and pressure using dummy fuel elements in the core. The reactor was brought critical and was generating electrical power one week later. Numerous low and high power performance tests were performed and the reactor reached its full rated power at 10 megawatts of heat. The temperature coefficient of the reactor was measured as -2.3×10^{-4}/°F and the pressure coefficient as 2 to 4×10^{-6}/psi at the operating conditions of 450°F and 1200 psi. Measurements were made to demonstrate that the reactor would be cooled by thermal convection in the event of loss of primary coolant flow. Data are presented on Xe buildup, shielding, and over-all plant heat balance, and the control of water purity in both the primary and secondary system is described. The APPR-1 has proven itself to be a reliable nuclear power plant with remarkable stability and it has operated so as to meet all design requirements. (auth)

6813 BNL-3145(Suppl.)

[Brookhaven National Lab., Upton, N. Y.]

CRITICAL ASSEMBLIES OF LIGHT WATER MODERATED, SLIGHTLY ENRICHED URANIUM ROD LATTICES AT BROOKHAVEN. Supplement to Hazards Summary Report. Herbert Kouts. Sept. 11, 1956. 25p.

6814 CEA-668

France. Commissariat a l'Energie Atomique, Paris.

EFFET D'UNE PERTURBATION DANS LE REFLECTEUR D'UNE PILE. CAS D'UN CANAL RADIAL. (Effect of a Perturbation in a Pile Reflector. Case of a Radial Channel). B. Lerouge and V. Raievski. Nov. 1957. 16p.

The loss of reactivity caused by absorption and the transport effect in a channel placed in a pile reflector are calculated in a two-group theory with limiting perturbation conditions. The results are applied to the EL3 reactor. (J.S.R.)

6815 CEA-688

France. Commissariat a l'Energie Atomique, Paris.

EXAMEN DES CARTOUCHES D'URANIUM SORTANT DE EL2. (Examination of Uranium Slugs Removed from EL2). G. Cherel and J. Bloch. June 15, 1957. 26p.

The uranium slugs from the various sets of rods in EL2 have been examined. This report gives the results of the first observations relating to distortions and surface condition of the slugs, and to modifications in the microstructure of the uranium. (auth)

6816 CF-55-5-103(Rev. 2)

Oak Ridge National Lab., Tenn.

A BIBLIOGRAPHIC FILE OF TECHNICAL REPORT ABSTRACTS USEFUL TO REACTOR CONTROL SYSTEM ENGINEERING. Francis P. Green. Mar. 1, 1958. 18p. Contract [W-7405-eng-26]. $0.50(OTS).

Report abstracts from more than 40 AEC and foreign facilities, AEC contractors, and technical periodicals are represented, published throughout the years 1941 to 1958. Cards for current publications are placed in the file no later than six weeks after the abstracts appear in the Abstracts of Classified Reports. (auth)

6817 CF-55-11-45

Oak Ridge National Lab., Tenn.

LET-DOWN SYSTEM DESIGN FOR HOMOGENEOUS REACTORS. R. E. Aven. Nov. 7, 1955. 25p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

A study was made to determine the feasibility of designing a gas let-down system for homogeneous reactors, in which the pressure is taken through a fairly long tube rather than across a throttling valve. A schematic design of such a system is shown for the HRT in which the let-down stream passes through parallel tubes. Control is effected by the cutting in or out of tubes as is needed. Calculations indicate such a design is feasible. It is recommended that experimental work be done before the adoption of this design. The experimental work should be designed to demonstrate the ease of control, determine the stability of the two phase flow in the system, determine the operating characteristics throughout the pressure, and temperature range expected, and determine the effect of an orifice on flow stability. (auth)

6818 CF-58-1-4

Oak Ridge National Lab., Tenn.

FLUXES OBTAINABLE IN A FLUX-TRAP REACTOR. W. K. Ergen. Jan. 15, 1958. 11p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The general computational method, described in a previous memorandum and applicable to an idealized flux-trap reactor, is used to obtain numerical values of the required multiplication factor ηf, and of the thermal flux ϕ_c in the center of the internal thermal column, for various radii of the fuel shell and for the following moderators: D_2O, Be, BeO, and C. The results are tabulated. For any given moderator, Φ_c reaches a maximum for a certain radius. For the four moderators listed above, this radius, the corresponding central flux ϕ_c (in n/cm^2 per fission neutron emitted) and the multiplication factor ηf, as well as the reactor power required to make the central flux equal to 10^{16} n/cm^2 sec are given. This power varies from 138 Mw for Be to 315 Mw for C. (auth)

6819 CF-58-1-42

Oak Ridge National Lab., Tenn.

DESIGN AND DEVELOPMENT OF A FLANGE DEWATERING DEVICE. B. D. Draper and T. E. Haynes. Feb. 10, 1958. 18p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Light water remaining above an ice plug in a vertical line following an underwater maintenance operation of the Homogeneous Reactor Test was flushed from the system by heavy water admitted through a soft copper secondary gasket with attached hypodermic tubing. Tests indicated approximately 90% of the light water could be removed by flushing 2 liters of heavy water through the 3.5-in. 2500 lb flange cavity. (auth)

6820 CF-58-1-97
Oak Ridge National Lab., Tenn.
HRP-CP: CONCLUSIONS CONCERNING THE PREDICTED BEHAVIOR OF INSOLUBLE CORROSION AND FISSION PRODUCTS IN THE HRT. P. A. Haas, W. D. Burch, R. W. Horton, and R. A. McNees. Jan. 23, 1958. 43p. Contract [W-7405-eng-26]. $7.80(ph OTS); $3.30(mf OTS).

Information available from HRP-CP development studies was summarized and used as a basis for predicting the probable behavior of corrosion and fission product solids in the HRT and its associated chemical processing plant. Operation of the chemical plant will probably limit the HRT circulating solids concentration to between 10 and 100 ppm; quantitative predictions are uncertain due to uncertainties concerning the characteristics of reactor solids and the effects of reactor geometries. (auth)

6821 CF-58-2-109
Oak Ridge National Lab., Tenn.
PHASE I—FOREIGN REACTOR FUEL SAMPLE IRRADIATION. IRRADIATION REQUEST ORNL-MTR-35. C. F. Leitten and W. C. Thurber. Feb. 24, 1958. 15p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

A series of in-pile fuel sample irradiation experiments was initiated to obtain radiation damage information on fuel material combinations applicable to Foreign Reactor Program Fuel Elements where U^{235} enrichment is limited to 20%. The series of experiments will be divided into several phases, each being based on the materials combination employed. This report describes Phase I of the program which consists of determining the integrity and suitability of a 48 wt. % U–3 wt. % Si–49 wt. % Al alloy as a fuel for Foreign Reactor Fuel Elements. (auth)

6822 CF-58-2-127
Oak Ridge National Lab., Tenn.
HIGH THERMAL-NEUTRON FLUX FROM FISSION OVER-SIMPLIFIED CASES. W. K. Ergen. Feb. 26, 1958. 10p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Two simplified models are discussed in order to gain insight into the problems of a flux-trap reactor. The first model consists of source of fission neutrons, embedded into D_2O, Be, BeO, or C moderator, or a moderator of zero absorption cross section. The source is assumed not to absorb any neutrons. This model gives five to eight times the thermal flux obtainable at the center of the flux-trap reactor. The other model is a flux-trap reactor idealized by neglecting all absorption in the moderator. This model does not differ markedly from the D_2O-moderator case. (auth)

6823 CF-58-3-27
Oak Ridge National Lab., Tenn.
FLUX-TRAP REACTOR WITH ABSORBER IN THE CENTER. W. K. Ergen. Mar. 4, 1958. 6p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

An idealized flux-trap reactor is modified by the insertion of an absorber. It is shown that, for appreciable absorption, a flux depression results, and the remaining flux is proportional to the diffusion constant D times the center flux in the nonabsorption case. This factor D just cancels the factor 1/D in the expression for this center flux so that the flux in the case with absorber is independent of D. In the case with absorber the advantage of Be and BeO largely disappears. (auth)

6824 CF-58-3-28
Oak Ridge National Lab., Tenn.
DECREASE IN HRE-3 BREEDING RATIO CAUSED BY ABSORPTIONS IN CORE TANK AND SHROUD. M. W. Rosenthal, T. B. Fowler, and M. Tobias. Mar. 3, 1958. 7p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80 (mf OTS).

The decrease in HRE-3 breeding ratio due to the presence of the Zircaloy core tank and shroud was examined as a function of metal thickness and spacing. For the case of a 1/2-in. thick core vessel and a 1/2-in. thick shroud spaced 5 in. apart, the breeding ratio would be 0.047 less than if there were no Zircaloy present. The absorption cross section used for Zircaloy-2 is consistent with an experimentally measured value and an estimate based on spectrographic and chemical analysis of HRT core tank material. The fraction of blanket power generated in the space between core tank and shroud was also determined. (auth)

6825 CISE-59
Centro Informazioni Studi Esperienze, Milan.
CALCOLO DI UN REATTORE SFERICO A PIU' REGIONI E A DUE GRUPPI CON UNA CALCOLATRICE ARITMETICA. (Calculation of a Spherical Reactor to Multi Regions and to Two Groups with an Arithmetical Computer.)
A. Ascari, G. Bortone, and L. Businaro. July 1956. 27p.

A method is presented which, although it has a rather complicated programming, has the advantage of a short calculation time and few rounding-off errors. It is particularly suitable for a calculation of limiting velocity. (tr-auth)

6826 E.443/N-14
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
REACTIVITY LOSS DUE TO XENON BUILD-UP. J. D. McCullen. Jan. 21, 1954. Decl. Nov. 29, 1957. 2p.

6827 HaR-676
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
REACTOR CONSTRUCTION AND USE. Lecture 7 given at Imperial College, February 23, 1951. J. Diamond. Feb. 26, 1951. 10p.

Power production by nuclear reactors is reviewed on a broad basis. Advantages and disadvantages of various reactor types are briefly summarized with respect to the economics of power requirements. The necessary characteristics of structural, moderating, and shielding materials are discussed. (J.S.R.)

6828 IDO-16404
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
KINETIC STUDIES ON THE SPERT I REACTOR. II. ON THE INITIAL SHUTDOWN OF THE SPERT I REACTOR FOR PERIODS GREATER THAN 50 MILLISECONDS. L. I. Deverall and G. W. Griffing. Dec. 26, 1957. 14p. Contract AT(10-1)-205. $0.50(OTS).

For transients of SPERT I initiated at approximately 20°C and where the reciprocal period is less than 20 sec^{-1}, the plate temperature does not rise sufficiently by the time of maximum power for boiling to have occurred. For this region one inquires whether it is possible that moderator expansion due to thermal effects is sufficient to have shut down the reactor. Using the observed temperature traces of the fuel plates an estimate of the temperature rise of the moderator can be made at the time of peak power and hence the amount of reactivity compensated. On the other hand, the compensated reactivity is also obtainable from the use of the observed power traces. A comparison of the two values indicates that the computations based on the temperature is lower than the one based on power by a factor of about two. Although this comparison suggests that other mechanisms are needed to explain the self-shutdown of the transients for reciprocal periods less than 20 sec^{-1}, there is the possibility that the discrepancy is not real due to the inherent inaccuracy of the available information. (auth)

6829 KAPL-M-FTB-1
Knolls Atomic Power Lab., Schenectady, N. Y.
SPECIAL PHYSICS INSTRUMENTATION FOR S3G. F. T. Burkett. Jan. 16, 1958. 13p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Tests of the S3G source and intermediate range equipment and special physics equipment for the source range were performed in the ATR facility. The performance of the physics equipment is reported. (auth)

6830 KAPL-M-SMS-54
Knolls Atomic Power Lab., Schenectady, N. Y.
EVALUATION OF HYDROCLONES FOR PURIFICATION SERVICE IN THE SAR POWER PLANT. W. W. Goodwin. Jan. 11, 1957. 4p. Contract W-31-109-Eng-52. $1.80 (ph OTS); $1.80(mf OTS).

At present, no hydroclone system is developed sufficiently to be attractive for S3G/S4G application. The two systems with satisfactory low waste rates either require moving machinery or complicated control. The question of what to do with the waste suggests that more equipment would be required. (M.H.R.)

6831 NAA-SR-1998
Atomic International Div., North American Aviation, Inc., Canoga Park, Calif.
PRELIMINARY HEAT TRANSFER STUDIES OF OMR FUEL ELEMENTS. E. B. Baumeister and C. W. Wheelock. Nov. 15, 1957. 44p. Contract AT-11-1-GEN-8. $1.25(OTS).

Heat transfer and pressure drop characteristics are investigated for several organic-moderated reactor fuel element types. Effects of longitudinal variations of fuel loading and flow rate also are studied. (auth)

6832 NAA-SR-2057
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
ORGANIC MODERATED REACTOR QUARTERLY PROGRESS REPORT [FOR] APRIL–JUNE 1957. E. F. Weisner. Mar. 1, 1958. 69p. Contract AT-11-1-GEN-8. $2.00 (OTS).

Work has been progressing on the development of components and systems for the Organic Moderated Reactor (OMR). Studies are under way for finding optimum parameters of fuel element design, flow rate, temperatures, and pressures in the primary system. Some tests were performed on components of the control rod; several fuel element cladding techniques were tried; and pressure drop measurements were made on representative samples of possible fuel element configurations. Equipment was ordered and some was received which will permit measurement of the physical properties of organics, measurement of gas solubilities, and determination of the components of irradiated organics. Corrosion samples have been sent to the OMRE for insertion when the reactor is loaded. The in-pile specimens are located in dummy fuel elements adjacent to the core; the out-of-pile specimens are located in the by-pass heater loop. (For preceding period see NAA-SR-1936.) (auth)

6833 NAA-SR-2151
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
PRELIMINARY DESIGN OF A CALANDRIA CORE FOR THE SODIUM REACTOR EXPERIMENT. J. E. Mahlmeister. [Nov. 15, 1957]. 58p. Contract AT-11-1-GEN-8. $1.75(OTS).

The design aspects of a calandria-type replacement core for the Sodium Reactor Experiment are considered. This alternate core design was made in consideration of the possibility that the existing Zr moderator cans might fail so frequently that the reactor become incapable of satisfactory operation. The calandria description and design basis, expected steady-state performance, and the methods and procedures for core cavity preparation and calandria installation are given. Recommendations are given for studies and tests which should be performed to confirm areas of detailed design and to further develop methods which would insure a successful core-changing operation. (auth)

6834 NP-6604
North Carolina State Coll., Raleigh.
MEASUREMENT AND ANALYSIS OF REACTIVITY VALUES OF CONTROL RODS (thesis). Thomas LeRoy Jackson. 1958. 96p.

Two experimental methods for measuring the reactivity of control elements were developed. The first uses the critical reactor and automatic adjustment of a calibrated control rod. The second employs the reciprocal count method in the subcritical region. The data taken in the two regions were consistent and surprisingly accurate. The theoretical analyses developed here for determining changes in reactivity in a critical reactor between an experimental water rod and boric acid rods of varying concentration using (1) a deduced relation between reactivity and "thermal leakage" in conjunction with one group–two region theory, and (2) two group–one region theory with extrapolation distances produce results that compare very favorably with experimental results. The analysis using two group–one region theory consistently predicts theoretical values of change in reactivity which are slightly lower than the experimental values. Thus the method appears to underestimate the values of reactivity change. In applying this method to the reactivity difference between a void and a water rod (where thermal leakage is of major importance) the theoretical and experimental results compare somewhat less favorably, and further investigation by more advanced methods is indicated. (auth)

6835 NYO-8503
Ford Instrument Co., Long Island City, N. Y.
DIGITAL ROD POSITION INDICATOR SYSTEM. Dec. 2, 1957. 24p. Contract AT(30-1)-1969.

The application of digital techniques to sensing the position of control rods in a pressurized water reactor, using no direct mechanical connection, so as to indicate rod position and relative spread (difference between highest and lowest rods in a given group), was investigated. (auth)

6836 TID-8016
Technical Information Service, AEC.
CONSTRUCTION OF FACILITIES FOR RADIOACTIVE WORK. C. N. Perleberg, Knolls Atomic Power Lab. Nov. 1, 1956. 9p. $0.50(OTS).

One of Its Monograph Series "The Industrial Atom."

The auxiliary facilities constructed at Knolls Atomic Power Laboratory for radioactive work are described. The concrete shielding is an aggregate composed of ferrophosphate and has a weight of 290 to 300 lb/ft^3. The air supply and exhaust system uses Chemical Warfare Service filters to remove any radio contaminants. The air outside the lab is monitored to insure that no radioactivity is being released above acceptable limits. The waste processing and storage are described. (J.S.R.)

6837 WAPD-P-681(Rev.)
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
FLUX DISTRIBUTION IN A HEAVILY LOADED REMOVABLE SUBASSEMBLY. G. Hopkins. Aug. 1955. 5p. $1.80(ph OTS); $1.80(mf OTS).

The insertion of a heavily loaded removable subassembly in a power core is being considered for power tests. An experimental determination of the neutron flux distribution was made in order to predict the temperatures of the uninstrumented portions of the core and subassembly relative to the one instrumented plate. The results indicate that the heavily loaded removable subassembly will not be appreciably hotter than the rest of the fuel plates. (auth)

6838

PHYSICS OF THE REACTOR CORE. P. D. D. Russell (General Electric Co., Erith, Eng.). Atomic Energy Rev. 1, 64-71(1957) Sept.

The physics of the reactor core and the long-term behavior of nuclear fuels are described, and relevant data, together with factors which have affected the design, are given. (W.L.H.)

6839

SELECTION OF FUEL-CANNING MATERIALS FOR CARBON-DIOXIDE-COOLED NUCLEAR REACTORS. B. C. Woodfine (General Electric Co.). Atomic Energy Rev. 1, 91-6(1957) Sept.

The various properties that a fuel element canning material must possess for a carbon-dioxide-cooled nuclear reactor of the Calder Hall type are discussed. (W.L.H.)

6840

A FISSION-PRODUCT DETECTION SYSTEM. J. B. B. Mills and P. F. Hartshorn (General Electric Co., Erith, Eng.) and R. D. Bryden (Salford Electrical Instruments, Ltd.). Atomic Energy Rev. 1, 97-104(1957) Sept.

A description is given of a fission-product detection system for gas-cooled reactors. A schematic diagram is given for a fuel-channel sampling system. (W.L.H.)

6841

RESEARCH SURVEY. Atomic Energy Rev. 1, 110-14 (1957) Sept.

The design of a nuclear power station is based on a vast amount of knowledge gained by careful research in widely diverse fields of science. At the present stage of development in Great Britain, the United Kingdom Atomic Energy Authority collaborates closely with the industrial firms that are undertaking to design and build nuclear reactors in the provision of basic data, chiefly on the nuclear properties and the behavior under irradiation of possible reactor materials. But at the same time a great deal of fundamental research, as well as development, is being done by the firms themselves. Among such concerns are the G.E.C. and those associated with it in the supply of complete nuclear power stations. Some of their research and development has been described in the accompanying articles. In this survey a few of the many other projects—some less spectacular, some continuing on a long-term basis, some hardly begun—are briefly described, as an indication of the diversity of effort and the ingenuity of experiment that are required for the successful application of nuclear power. (auth)

6842

THE HIGH-TEMPERATURE GAS-COOLED REACTOR. Atomic Energy Rev. 1, 115(1958) Sept.

6843

PUMPS AND FANS IN A NUCLEAR POWER STATION. Electromagnetic Pumping of Liquid Metals, Process Pumps, Pumping Liquid Metals, Unusual Pumps for Unusual Duties, Gas Compressors, Fans and Blowers, and Selection of Materials for Pump Manufacture. Atomics and Nuclear Energy 9, 41-57, 71(1958) Feb.

6844

THE DRESDEN NUCLEAR POWER STATION. Atomics and Nuclear Energy 9, 62-6(1958) Feb.

Details of the installation are given. Diagrams are included on: the flow of the dual cycle boiling water reactor system, the heat balance of the system, the main constructional materials, the core assembly, the arrangement of fuel elements and control rods, the canned rotor reactor circulating pump, and the reactor vessel and core assembly. (M.H.R.)

6845

JAPAN'S FIRST REACTOR. Atomics and Nuclear Energy 9, 96-7(1958) Mar.

The reactor built by Atomics, Inc., of New York for the Japanese Atomic Energy Research Inst. is a 10 Mw research reactor and is installed at Tokai-Mura. Heavy water is used as moderator, coolant, and reflector. The usual graphite reflector has been eliminated, and a special thermal shield consisting of alternate layers of steel and light water has been incorporated. Other design data and auxiliary installations are presented. (J.E.D.)

6846

THE SOVIET UNION. Atomics and Nuclear Energy 9, 108-9(1958) Mar.

6847

TRANSPORT THEORY TREATMENT OF SMALL CRITICAL ASSEMBLIES. II. Klaus O. Thielheim. Atomkern-Energie 3, 2-5(1958) Jan. (In German)

A method is given to estimate the critical size of fast critical assemblies (such as the Godiva type) and the dependence of the neutron flux on position and energy in geometrically simple cases. A multigroup theory was used in which the neutron groups were defined according to the multiplicity of inelastic scattering. (tr-auth)

6848

THE TRANSIENT BEHAVIOR OF BOILING WATER REACTORS. A. Kirchenmayer (Elektrotechnische Fakultät der Universität, Belgrade). Atomkern-Energie 3, 6-10 (1958) Jan. (In German)

The oscillatory behavior of a boiling water reactor was calculated for small power variations. The total transfer factor of reactors, their stability, and the transition functions were considered. (J.S.R.)

6849

AMBIGUITY IN CONNECTION WITH THE IDEA OF NEUTRON GENERATION. P. St. Putter (Atomenergieabteilung der Babcockwerke, Oberhausen, Germany). Atomkern-Energie 3, 11-15(1958) Jan. (In German)

Ambiguities in connection with neutron generation were indicated. These ambiguities were shown in the example of reactors with epithermal fissions. Using two different physically significant definitions of neutron generation, the propagation factor and the conversion factor of reactors was calculated. When the two factors are different according to the definitions used, the reactor is sub- or supercritical. In the critical reactor, the formulas derived are independent of the definition used. (J.S.R.)

6850

FLUX FINE STRUCTURE IN GAS COOLED REACTOR CELLS. Gerhard Riesch (AEG-Kernenergie-anlagen, Frankfurt am Main). Atomkern-Energie 3, 16-21(1958) Jan. (In German)

The calculations of Newmarch on the flux fine structure in a cylindrical cell with gas cooled central fuel rods were expanded for bundles of fuel rods. (J.S.R.)

6851

THE FAST REACTOR AT DOUNREAY. H. Grümm. Atomkern-Energie 3, 28-32(1958) Jan. (In German)

The design, construction, and operation of the Dounreay Fast Reactor are reviewed. (J.S.R.)

6852

STARTING OPERATION OF THE SRE GRAPHITE REAC-

TOR. K. Yu (Yu. K.). Atomnaya Energiya 3, No. 10, 363-4(1957).

On 4/25/1957 the SRE reactor was put into operation. Its thermal capacity amounts to 20 Mw and from this 7.5 Mw can be used as electrical capacity. The initial temperature amounts to 260°C and output temperature to 516°C. Graphite columns (hexagonal cross section) are used as moderators, which are encased in zirconium. Seven fuel elements are fitted in one on top of the other. The lattice distance between the fuel elements amounts to 26.4 cm. The active zone and the reflector are fitted into a steel tank of a diameter of about 330 cm and a height of about 570 cm. Costs of production are estimated at about 3.5 to 6.8 million dollars. (T.C.O.)

6853

THE EFFECT OF THE COOLING SYSTEM ON THE INDUSTRIAL EFFICIENCY OF THE NUCLEAR REACTOR. Andreas Setzwein. Atomwirtschaft 3, 6-10(1958) Jan. (In German)

The effect of the cooling system on the cost of energy production was considered on the basis of plant cost, fuel element cost, and operation and maintenance cost. (J.S.R.)

6854

FISSION MATERIAL LOADING PLAN FOR NUCLEAR REACTORS. A. Setzwein (Brown, Boveri & Cie, AG, Mannheim, Germany). Atomwirtschaft 3, 63-70(1958) Feb. (In German)

The effect of the fuel loading plan on the cost of energy production with nuclear reactors is discussed. (J.S.R.)

6855

NUCLEAR PROCESS HEAT REACTORS. Bernard W. Gamson (Borg-Warner Corp., Des Plaines, Ill.). Chem. Eng. Progr. 54, No. 2, 74-8(1958) Feb.

A large potential market exists for the application of nuclear heat to the process industries. Existing technology with minor improvements could produce low pressure steam competitive with fossil fuel. The application of nuclear reactors to chemical and metallurgical processing involves a large number of problems, depending upon the specific system proposed. Designs will be compromises between the optimum nuclear, thermodynamic, metallurgical, and size factors. (auth)

6856

PHYSICAL AND CHEMICAL BEHAVIOR OF HEAVY WATER DURING REACTOR OPERATION. Donald W. Kuhn (U. S. Atomic Energy Commission, Aiken, S. C.). Énergie nucléaire 1, 77-9(1957) Apr.-June. (In French)

In a heterogeneous reactor moderated and cooled by heavy water, the problem of decomposition of the heavy water by radiation and the formation of impurities by corrosion should be considered. A method for maintaining the purity of the moderator and reducing the radiolysis is proposed. (tr-auth)

6857

THE FRENCH CENTER FOR PLUTONIUM PRODUCTION AT MARCOULE. Énergie nucléaire 1, 141-4(1957) July-Sept. (In French)

The principal characteristics of the G1, G2, and G3 piles at Marcoule and the electrical power plants with which they are associated are described. (J.S.R.)

6858

INSTRUMENTATION FOR SOLUTION-LOOP EXPERIMENTS INSIDE A NUCLEAR PILE. John A. Russell, Jr. (Oak Ridge National Lab., Tenn.). ISA Journal 4, 4p. (1957) Sept.

The instrumentation and control developed at Oak Ridge National Laboratory for in-pile pumped solution loops are discussed. (M.H.R.)

6859

THE APPLICATION OF FLUIDIZATION TECHNIQUES TO NUCLEAR REACTORS. J. B. Morris, C. M. Nicholls, and F. W. Fenning (A.E.R.E., Harwell, Eng.). J. Brit. Nuclear Energy Conf. 2, 1-19(1957) Jan.

The paper considers critically the possibilities of applying fluidization techniques to nuclear reactors. Fuel investment considerations lead the authors to favor at present a reactor working with 'thermal' rather than 'fast' neutrons. While the neutron balance can be disturbed by changes in temperature and pressure, the most sensitive variable in a fluidized system will be the concentration of the moderator and fuel in the reactor volume. The large amount of heat accompanying nuclear fission brings limitations on the types of fluidization systems that are feasible. On considerations of heat removal, a number of systems worthy of further consideration can be postulated. A useful amount of heat can be extracted from a fluidized bed by simple gas cooling only if powders are used coarser than normal in industrial practice and if gas under pressure (~100 atm) is employed. The most favorable gases are considered. Pressurized and non-pressurized liquid systems are discussed, and a 'mixed phase' arrangement is described. (auth)

6860

SYMPOSIUM: CALDER WORKS NUCLEAR POWER PLANT. J. Brit. Nuclear Energy Conf. 2, 41-232(1957) Apr.

The symposium on Calder Works Nuclear Power Plant, arranged by the British Nuclear Energy Conference, was held on November 22 and 23, 1956. The nineteen papers cover all the important features of planning, design, and construction. (auth)

6861

SYMPOSIUM ON CALDER WORKS NUCLEAR POWER PLANT. J. Brit. Nuclear Energy Conf. 2, 233-91(1957) July.

The symposium on Calder Works Nuclear Power Plant, arranged by the British Nuclear Energy Conference, was held on November 22 and 23, 1956. This issue contains the general reports and the discussions. (auth)

6862

FRANCE'S NEW HIGH-FLUX RESEARCH REACTOR. "EL 3." Gilbert B. Mélèse (Centre d'Etudes Nucleaires de Saclay, France). Nuclear Eng. 3, No. 24, 115-20(1958) Mar.

A detailed description is given of France's new high-flux research reactor (EL-3) which went critical July 4, 1957. The reactor is heavy water moderated and cooled. It has a neutron flux of 10^{14} n/cm^2-sec with a thermal output of 15 Mw. (W.L.H.)

6863

AN ELECTRICAL PROCESS CONTROL SYSTEM FOR NUCLEAR POWER PLANT. J. C. Nutter (Elliott Bros., Ltd., London). Nuclear Power 3, 98-100(1958) Mar.

A description is given of an electrical process control system (Swartout) which has been proved in conventional industrial plant operation and which, by virtue of the flexibility in its design, is readily applicable to the special problems involved in control of nuclear plants. The basic system component, primary measurements, indication and recording, and control are discussed. Examples of nuclear plant control utilizing the Swartout system are considered. (J.S.R.)

6864

APPR FUEL ELEMENTS. FABRICATION TECHNIQUE. Nuclear Power 3, 110-11(1958) Mar.

The Army Package Power Reactor utilizes stainless-steel-clad uranium dioxide fuel plates. The uranium di-

oxide is sintered with tungsten dioxide, boron carbide, and stainless steel powder. The sintered plates are then clad with stainless steel, hot rolled to bond them, and then cold rolled to final size. (J.S.R.)

6865

FAST-BREEDER POWER REACTORS: WHERE DOES U.S. PROGRAM STAND? L. J. Koch (Argonne National Lab., Lemont, Ill.). Nucleonics 16, No. 3, 68-74(1958) Mar.

The present activities in the U. S. program on fast breeder power reactors are outlined. The development of fuel materials and designs, reactor systems and components, and fuel processing and fabrication are discussed. A brief discussion of the fast reactor projects under construction—the Experimental Breeder Reactor-II, Los Alamos Molten Plutonium Reactor Experiment-I, and the Enrico Fermi Fast Breeder Reactor—is given. Brief paragraphs are devoted to a comparison of the nuclear parameters for fast and thermal power reactors and to the U. K. fast reactor program. (J.S.R.)

6866

SIMULATING NUCLEAR BLAST EFFECTS. James R. Bohannon, Jr. (Wright Air Development Center, Dayton, Ohio) and Wilfred E. Baker (Aberdeen Proving Ground, Md.). Nucleonics 16, No. 3, 75-9(1958) Mar.

A summary of blast effects testing of a one-quarter scale model of the Air Force Nuclear Engineering Test Reactor is presented. An analysis of the test results indicates that the full-scale design can safely contain nuclear energy releases exceeding that in the maximum credible accident. The validity of assumptions made in the analysis is discussed in paragraphs following the article. (J.S.R.)

6867

XENON SPATIAL OSCILLATIONS. D. Randall and D. S. St. John (E. I. du Pont de Nemours & Co., Inc., Aiken, S. C.). Nucleonics 16, No. 3, 82-6, 129(1958) Mar.

In a large thermal reactor operating at high flux levels, the periodic redistribution of xenon poisoning causes oscillation in the power distribution. Ward's perturbation method for computing the oscillation threshold is extended to reactors with power distributions that differ significantly from the fundamental shapes. The methods developed predict the oscillation threshold with a minimum of computation. (J.S.R.)

6868

BOILING-WATER-REACTOR INSTABILITY. Joseph A. Thie (Argonne National Lab., Lemont, Ill.). Nucleonics 16, No. 3, 102, 104-11(1958) Mar.

The observed oscillatory behavior of five ANL boiling reactors—the Borax I, II, III, IV, and the Experimental Boiling Water Reactor—are described. The amplitude, frequency, temperature, and threshold of the oscillation are recorded. The kinetic theory of oscillations is illustrated by a simplified model using a single series feedback loop and linearized one group kinetic equations. Experimental approaches to more complete understanding of reactor instability are described. Semiempirical techniques which can be used to obtain information about the unstable point from a rod oscillator experiment are given. (J.S.R.)

6869

HAZARDS EVALUATION OF THE YANKEE REACTOR. Clifford K. Beck (Atomic Energy Commission, Washington). Nucleonics 16, No. 3, 112-14(1958) Mar.

Testimony on the safety of the Yankee Reactor is summarized. The design is similar to the Pressurized Water Reactor. Unique features of this reactor, with respect to hazards evaluation, include a chemical shutdown system, nucleate boiling in parts of the core at full power, and large Pu buildup as a result of the long operating cycle. (J.S.R.)

6870

A SIMPLIFIED P_3 APPROXIMATION METHOD FOR CALCULATING THERMAL UTILIZATION. Earl M. Page and Raymond L. Murray (North Carolina State Coll., Raleigh). Nucleonics 16, No. 3, 114-15(1958) Mar.

In the simplified calculation of the thermal utilization, the P_3 approximation is reformulated for plate systems in such a way that the thermal utilization is computed directly in terms of the F and E factors of diffusion cell theory. The only simplifying approximation made is that the absorption cross section of the moderator is small compared with its scattering cross section. This condition is met for any practical heterogeneous reactor. (J.S.R.)

6871

PREDICTING REACTIVITY AT HIGH BURNUP. Bertram Wolfe (General Electric Co., San Jose, Calif.). Nucleonics 16, No. 3, 116-21(1958) Mar.

A simple perturbation technique is described that can be used to calculate burnup effects in highly enriched thermal reactors, taking into account the spatial variations of the burnup. On the basis of a single standard computation of a uniformly loaded core, the change in reactivity with time in a high flux reactor can be calculated. The technique is well suited for determining the effect of a burnable poison and the optimum poison and fuel loading. An appendix gives the thermal flux distribution stability. (J.S.R.)

6872

METHODS OF DETERMINING TRACES OF IMPURITIES IN REACTOR MATERIALS. J. Minczewski (Inst. of Nuclear Research, Warsaw). Nucleonika 2, 617-29(1957). (In Polish)

Analytical methods for the determination of impurities in reactor materials are discussed with special emphasis on the methods developed in Poland. Determination of boron in graphite and methods used for determining Li, Na, K, and Ca and the nuclear purity of uranium and other subsidiary materials are described. (tr-auth)

6873

ON THE STUDIES OF HOMOGENEOUS REACTORS IN JUGOSLAVIA. B. Kuchowicz (Inst. of Nuclear Studies, Warsaw). Nucleonika 2, 667-9(1957). (In Polish)

Nuclear Transformation

6874 NP-6624

Pennsylvania. Univ., Philadelphia.

ENERGY AND ANGULAR DISTRIBUTIONS OF PHOTOPROTONS FROM NITROGEN-15. Technical Report No. 3. Jacob L. Rhodes. Feb. 1958. 116p. Contract N-onr-551 (17).

Nitrogen gas, enriched 95.7% in N^{15}, was exposed to betatron bremsstrahlung of 18.7 and 24.6 Mev maximum energy, and the photoprotons resulting from the reaction $N^{15}(\gamma,p)C^{14}$ were detected in nuclear emulsions. The energy and angular distributions of the protons were determined as were the photoproton yield and cross section. The yield with 18.7 Mev bremsstrahlung was 2.06 ($\pm$0.3) $\times$ 10^4 protons/atomic weight/roentgen, while the yield with 24.6 Mev bremsstrahlung was 1.06 ($\pm$0.14) $\times$ 10^5 protons/atomic weight/roentgen. The integrated cross section from threshold up to 24.6 Mev for photoprotons in which the residual nucleus is left in its ground state was 14.5 ($\pm$1.5) Mev-mb, while the integrated cross section over the same energy range for transitions in which the residual nucleus is left in excited states was 24 ($\pm$5) Mev-mb, giving a total photoproton cross section over this energy interval of 38 ($\pm$5) Mev-mb. In addition to the "gian resonance" extending from 19 to 24 Mev with integrated cross

section equal to 10.3 Mev-mb the cross section vs. photon energy curve for ground state transitions shows small peaks at 11.6 Mev, at 15 Mev, and at 18.6 Mev, with integrated cross sections of 0.80, 1.47, and 0.75 Mev-mb, respectively. A narrow peak at 20.5 Mev in the "giant resonance" region has an integrated cross section of about 0.5 Mev-mb. The angular distributions of the various proton groups fit curves of the form $A + \sin^2\theta\ (1 + \beta\cos\theta)^2$. The asymmetry coefficient is approximately equal to 0.3. For protons of energy less than 9 Mev, the ratio A/B is found to be consistent with calculated distributions of protons emitted from isolated energy levels in the target nucleus. For protons of energy greater than 9 Mev a predominantly $\sin^2\theta$ distribution was found; the reduced isotropic component observed in the angular distribution of these protons is attributed to interference in s-wave and d-wave protons emitted from overlapping states accessible by electric dipole absorption in N^{15}. (auth)

6875 AEC-tr-2336

NUCLEAR FISSION REACTIONS WITH NEGATIVE PIONS AND FAST PROTONS. N. A. Perfilov, N. S. Ivanova, O. V. Lozhkin, V. I. Ostroumov, and V. P. Shanov. Translated from p.79-96 in Meetings of the Division of Chemical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 378p.

Nuclear fission reactions were observed with nuclear emulsions impregnated with tungsten, bismuth, and uranium. The fraction of pions leading to fission was 0.3 to 0.4 for the uranium, ≈0.02 for the bismuth, and <0.002 for tungsten. In the rest of the cases the π^- gives rise to a 1 prong or 0 prong star. The distribution of ranges for uranium fission shows a single maximum. About 10% of the uranium fission events were associated with emission of light charged particles. A possible fission mechanism was discussed. Fissions produced by 460 and 660 Mev protons were also studied in the same nuclei. The energy of excitation and fission cross sections were determined. The distribution in angle and ranges of fission fragments were discussed as a function of the energy of excitation of the fissioning nucleus. (J.S.R.)

6876 AEC-tr-2896

RESONANCES (n,n) AND THE (n,p) REACTION IN P^{31} AND S^{32}. R. Ricamo. Translated from Nuovo cimento 8, 383-402(1951). 24p.

The total cross section was measured and compared with the cross section for the (n,p) reaction for P^{31} and S^{32} for neutrons with energies between 1.9 and 3.66 Mev. The measuring techniques are discussed in detail. In the case of sulfur, the maxima of the two methods coincide up to 3 Mev; in the case of phosphorus they coincide only up to 2.5 Mev. The conclusion is drawn from this that at elevated energies the idea of an intermediate nucleus is no longer acceptable without some modifications. (auth)

6877

THE PROBLEM OF THERMONUCLEAR POWER. 1. E. W. Titterton (Australian National Univ., Canberra). Atomics and Nuclear Energy 9, 81-3, 110(1958) Mar.

6878

A SURVEY OF CONTROLLED FUSION. 1. Max Hoyauz (A.C.E.C., Charleroi, Belgium). Atomics and Nuclear Energy 9, 84-5, 110(1958) Mar.

6879

INTERACTIONS OF 1 Bev PROTONS WITH HEAVY AND LIGHT NUCLEI. 1. USE OF THIN PHOTOGRAPHIC EMULSIONS. EFFECTIVE CROSS SECTIONS OF THE INTERACTION. METHODS OF REACTION. Georges Philbert (College of France, Paris). J. phys. radium 18, 656-62(1957) Dec. (In French)

Corrected and detailed analysis is offered for previous investigations on interactions of 1-Bev protons with light nuclei (C,N,O) and heavy nuclei (Br, Ag). Techniques of thin emulsions used in determination of effective cross sections and the modes of reaction are described. Emission properties of charged particles are analyzed. (R.V.J.)

6880

REACTION $Al^{27}(p,\gamma)Si^{28}$. P. Marin, J. Movchet, and J. Poupaud. J. phys. radium 18, 693-4(1957) Dec. (In French)

Observations of the $Al^{27}(p,\gamma)Si^{28}$ reaction at 2.3 Mev detected a number of resonances in the effective cross section. These resonances were distributed within the region of several tenths of a kev. A much stronger resonance was observed in the region between 1.4 and 2.3 Mev, which was explored by Schoemaker et al. (Phys. Rev. 83, 1011(1957)). A table is presented of the resonance energies (p,γ) and (p,α) measured by Schoemaker and the resonance energies of the reaction $Al^{27}(p,\gamma)Si^{28}$. The table shows that among the six new resonances of (p,γ), four coincide with the resonances of (p,p) and (p,α) measured by Schoemaker. (R.V.J.)

6881

GAMMA RAYS FROM C^{13} + d AND THE EXCITED STATES OF C^{14}. E. K. Warburton and H. J. Rose (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 109, 1199-1210 (1958) Feb. 15.

A study has been made of the γ rays produced by the bombardment of C^{13} by deuterons from the Brookhaven Van de Graaff accelerator with particular emphasis on the γ rays from the $C^{13}(d,p)C^{14}$ reaction. A search for C^{14} γ-emitting states and cascade transitions was made using a three-crystal pair spectrometer and other scintillation counters at bombarding energies up to 3.7 Mev. From coincidence measurements the assignment of the 0.81-Mev γ ray to the cascade transition between the C^{14} 6.89- and 6.09-Mev states was confirmed and a previously unreported 0.62-Mev γ ray was assigned to the cascade transition between the C^{14} 7.35- and 6.72-Mev states. Limits on the lifetimes of the C^{14} 6.89-, 6.72-, and 6.1-Mev states were obtained from measurements of the Doppler shifts of the 0.81-, 6.72-, and 6.1-Mev γ rays. The lifetime limit for the 6.72-Mev state was combined with previous measurements to give a most probable assignment of $J^\pi = 3^-$ for the 6.72-Mev state, while the lifetime limit for the C^{14} 6.89-Mev state showed that the 0.81-Mev transition is chiefly dipole. Measurements of the angular correlation of the 0.81- and 6.1-Mev γ rays were interpreted by expressing the angular correlation functions in terms of the relative populations of the magnetic substates of the C^{14} 6.89-Mev state. By this method an assignment of $J = 0$ was obtained for the C^{14} 6.89-Mev state. (auth)

6882

COMPOUND STATES FORMED IN THE REACTION Ca^{40} $(p,p'e^+e^-)$. R. D. Bent and T. H. Kruse (Columbia Univ., New York). Phys. Rev. 109, 1240-2(1958) Feb. 15.

The absolute yield of electric monopole pairs from the $Ca^{40}(p,p'e^+e^-)$ reaction has been measured as a function of bombarding energy from E_p = 4.1 to 6.0 Mev. The pairs, resulting from the decay of the 0^+ first excited state of Ca^{40} at 3.35 Mev to the 0^+ ground state, were detected with a scintillation pair spectrometer. Weak resonances were observed at 4.42, 4.74, and 4.90 Mev bombarding energy. Resonances about 20 times stronger were observed at E_p = 5.02 and 5.08 Mev and higher energies. Seventeen resonances were observed between 5.0- and 6.0-Mev bombarding energy. The reduced widths and spacings of levels in

the compound nucleus Sc^{41} at 5.9- to 6.6-Mev excitation energy are derived from these data. (auth)

6883

PROTON STRENGTH FUNCTIONS FROM (p,n) CROSS SECTIONS. C. H. Johnson, A. Galonsky, and J. P. Ulrich (Oak Ridge National Lab., Tenn.). Phys. Rev. 109, 1243-54(1958) Feb. 15.

To an accuracy of ± 10%, (p,n) total cross sections averaged over resonances have been measured from threshold to about 500 kev above threshold for 12 nuclei from Cl^{37} to Nb^{93}. For each nucleus the excitation function of the average cross section is a monotonically increasing function of proton energy. At 500 kev above threshold the cross sections vary from 40 mb for Cl^{37} to 5×10^{-4} mb for Nb^{93}. One new threshold, that for $Se^{77}(p,n)Br^{77}$, was found to be 2.175 ± 0.004 Mev. In the course of calibrating the neutron detector with an Sb-Be source, a new determination was made of the Sb^{124} half-life: 59.9 ± 0.5 days. A black-nucleus square-well model was used to compute the cross sections for formation of the compound system. The Coulomb penetrabilities that appear in this calculation qualitatively account for the very large range of cross sections observed. In a more detailed comparison compound-nucleus formation was assumed, and the Hauser-Feshbach formalism was used to include the effects of proton and, especially, γ-ray emission from the compound nucleus. In general, there is agreement with the shapes of the excitation functions but not always with the magnitudes. The ratio of observed to black-nucleus cross-section peaks up by about a factor of 2 between Cu^{65} and Se^{82}. The maximum in the peak is between masses 70 and 75. This peak may be correlated (by a complex-potential model) with a peak in the strength function for s-wave protons and, to a lesser extent, with a peak in the strength function for d-wave protons. Proton strength functions were calculated for a complex square-well of radius $R = 1.45\ A^{1/3} \times 10^{-13}$ cm with the approximation of a Coulomb potential constant inside the well and equal to $(4/3)(Ze^2/R)$. In order to fit the observed position of the peak, A ~ 70 to 75, the depth of the specifically nuclear part of the well was required to be 46 Mev, 4 Mev deeper than the neutron well of Feshbach, Porter, and Weisskopf. (auth)

6884

NUCLEON EXCHANGE EFFECTS IN THE $B^{10}(d,p)$ STRIPPING REACTION. N. T. S. Evans (Cavendish Lab., Cambridge, Eng.) and A. P. French (Univ. of South Carolina, Columbia). Phys. Rev. 109, 1272-6(1958) Feb. 15.

The consequences of an exchange contribution to a specific stripping reaction are worked out in some detail. The particular transition considered is that which leads to the first excited state of B^{11} and which is forbidden by the angular momentum restrictions of ordinary stripping theory. The exchange calculation provides a fair measure of agreement with experiment on the angular distribution, yield, and energy dependence of the reaction. The relation of the present analysis to treatments of heavy-particle and spin-flip stripping is briefly discussed. (auth)

6885

EXPERIMENTAL EVIDENCE FOR THE REACTION d + T → He^3 + n + n − 3 Mev. J. E. Brolley, Jr., W. S. Hall, L. Rosen, and L. Stewart (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 109, 1277-9(1958) Feb. 15.

A continuum of doubly charged particles has been observed from the interaction of 12- and 14-Mev deuterons with tritium. They are shown to arise from the $H^3(d,2n)He^3$ reaction. Absolute differential cross sections are obtained. No evidence for the formation of a dineutron in a bound state, or in a well-defined virtual state, was found. (auth)

6886

REFRACTION EFFECTS IN DIRECT NUCLEAR REACTIONS. N. Austern and S. T. Butler (Univ. of Sydney). Phys. Rev. 109, 1402-3(1958) Feb. 15.

6887

THE INVERSE REACTIONS $B^{11}(p,\gamma)C^{12}$ AND $C^{12}(\gamma,p)B^{11}$. Lennart Simons. Soc. Sci. Fennica, Commentationes Phys. Math. 22, No. 3. 14p. (1957).

In order to obtain a conception of the common compound channels for the inverse reactions $B^{11}(p,\gamma)C^{12}$ and $C^{12}(\gamma,p)B^{11}$, the cross section for the pure inverted process to the reaction $B^{11}(p,\gamma)C^{12}$ was calculated according to the reciprocity theorem, i.e., for the distribution relating to orbital angular momenta of the protons that have occurred in $B^{11}(p,\gamma)C^{12}$ experiments, which distribution is unknown but can be considered, for equal energy, to be equal on the whole in all these experiments. The cross section obtained in this manner was compared in the common energy range of about 2 Mev with the experimentally found cross section for the $C^{12}(\gamma,p)B^{11}$ reaction. It appears as that common channels comprised a considerable part of the experimental $B^{11}(p,\gamma)C^{12}$ process but only a small part of the experimental $C^{12}(\gamma,p)B^{11}$ process. This is clearly connected with the unusually ample proton yield which was obtained of the reaction in the vicinity of the »giant resonance» peak and which is considered to be due to the fact that γ quanta frequently react with single protons in the C^{12} nucleus instead of with the entire nucleus. The previously stated spin and parity 2^+ for the 16.10, 18.3 and 19.2 Mev levels, and 1^- for the 17.22 Mev level of C^{12} are compatible with both inverse processes, but there is probably at least one further 1^- level among the recently discovered levels of comparatively high energy or among yet undiscovered resonance levels. (auth)

6888

ENERGY DISTRIBUTION OF NEUTRONS EMITTED FROM BERYLLIUM BOMBARDED BY 680 Mev PROTONS. V. Kiselev and V. B. Fliagin (Joint Inst. for Nuclear Research). Soviet Phys. JETP 5, 786-8(1957) Dec.

The neutron energy spectra were measured at angles of 0 and 18° in the laboratory system. A peak not observed at lower primary-proton energies was detected in the 100 to 400 Mev region. The existence of this peak is explained by π-meson production processes. (auth)

6889

SOFT GAMMA RAYS EMITTED BY NUCLEI IN THE CAPTURE OF THERMAL NEUTRONS. I. V. Estulin, L. F. Kalinkin, and A. S. Melioranskii (Moscow State Univ.). Soviet Phys. JETP 5, 801-12(1957) Dec.

A luminescent spectrometer was used to measure the energy and absolute intensities of gamma rays emitted by Co^{59}, Rh^{103}, I^{127}, Sm^{149}, Au^{197}, and Hg^{199} nuclei capturing thermal neutrons. It is shown that the detected gamma lines which lie in the 50 to 500 kev energy range can be ascribed to transitions from the lowest excited states of the investigated nuclei. (auth)

6890

ELECTRIC MONOPOLE TRANSITIONS OF ATOMIC NUCLEI. D. P. Grechukhin. Soviet Phys. JETP 5, 846-58 (1957) Dec.

Processes arising in E0 transitions in nuclei are considered. Equations are derived for the probabilities of shell electron conversion, pair production, two-photon transitions, and electron scattering cross section involving excitation of the E0 nuclear transition. The calculations are carried out with Coulomb functions of the electron with allowance for the finite dimensions of the nucleus. The conversion probability in an E0 nuclear transition is compared

with the competing E2 and M1 nuclear transitions. Some estimates are given for the E0 nuclear transition matrix element for various single-particle and collective nuclear models. (auth)

Particle Accelerators

Refer also to abstracts 7035, 7040, and 7046.

6891 AERE-T/M-155
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
INJECTION INTO THE 7 GeV SYNCHROTRON. Mary Bell. Jan. 1958. 21p.

Calculations were made on a linear approximation to determine the best choice of Q_R and of field rise at injection into the 7 Bev proton synchrotron. It is found that at the commensurate values of Q_R of 2/3 and 3/4 the acceptance area for the injected beam has small radial width and large angular divergence. Between these values the area has larger width and smaller divergence but is roughly of the same magnitude. Consideration of injection optics suggests the latter as the better choice. The optimum choice of field rise appears to lie between 2 and 4 kilogauss/sec. (auth)

6892 INSJ-2
Tokyo Univ. Inst. for Nuclear Study.
REPORTS ON THE WIDE RANGE MAGNET FOR 160 cm SYNCHROCYCLOTRON. H. Kumagai, K. Matsuda, T. Mikumo, K. Nisimura, S. Kobayashi, and H. Ogawa. June 13, 1957. 20p.

A wide range cyclotron magnet was designed for the dual purpose of a synchro- and ordinary cyclotron. The results of measurements on the magnet are described. It gives adequate fields for cyclotron operation for all field values up to 1.76 Wb/m^2 without any change of the Rose shim. The magnets also have coils wound inside the Fe of the poles, called electromagnetic shim, by which the field distribution under the operating condition of the cyclotron can be changed. The methods for field measurements are also described, including a new method for median plane location. (auth)

6893 MURA-379
Midwestern Universities Research Assn., Madison, Wis.
THE NON-LINEAR COUPLING RESONANCES OF AN ACCELERATOR. G. Parzen. Oct. 1, 1957. 22p. Contract AT(11-1)-1384. $4.80(ph OTS); $2.70(mf OTS).

The problem of finding the stability limits due to the $V_x + 2V_y = N$ coupling resonances and the threshold for y-growth due to the $V_x - 2V_y = 0$ resonance is treated. The general spiral sector machine is treated in detail. The results of the theory are compared with numerically computed results. (auth)

6894 NAA-SR-MTA-3
North American Aviation, Inc., [Downey, Calif.]
DETAILED PROCEDURE FOR LATTICE CALCULATION. E. Richard Cohen. Feb. 19, 1951. Decl. Feb. 27, 1957. 14p. $3.30(ph OTS); $2.40(mf OTS).

A detailed program of calculations for MTA lattice characteristics is presented. The calculation program includes four values of uranium enrichment ratio (normal concentration and three depletion factors) and three possible moderator choices (graphite, H_2O, D_2O). The constants involved are considered to be the best numbers available. (auth)

6895
ON THE PROBLEM OF THE MOTION CHARGED PARTICLES IN THE CENTRAL AREA OF A CYCLOTRON. V. S. Panasyuk. Atomnaya Energiya 3, No. 10, 341-4(1957).

By the introduction of a new ion optical system, i.e., by improvement of the lens for the first acceleration, it is possible to improve considerably the stability of cyclotron operation within the central domain of the quantum. Measuring of the power lines of the lens makes it possible better to follow the movement of the ions in the horizontal as well as in the vertical plane and thus to carry out new constructions satisfactorily. (T.C.O.)

6896
REGENERATIVE BEAM EXTRACTION ON THE BUENOS AIRES SYNCHROCYCLOTRON. Santos Mayo, Carlos A. Heras, and Jorge Rosenblatt (Comisión Nacional de Energía Atómica, Buenos Aires). Nuclear Instr. 2, 9-12 (1958) Jan.

The nonlinear regenerative theory was applied to the extraction of the deuteron beam of the Buenos Aires 30 Mev synchrocyclotron. The theory of LeCouteur proved successful even though the approximation of the n(r) curve with two straight lines gives an n-value for the extraction radius very different from the actual one for that radius. A regenerator field of the form $T = 0.05\,\rho + 0.11\,\rho^2$ produced a radial gain up to 1.5 cm. An electrostatic channel extended over a 30° arc with a 80 kv/cm field deflected the beam 3 cm out. A magnetic channel following the electrostatic one brought the beam out from the cyclotron vacuum chamber. A fraction of 2 to 3% of the internal beam could be removed by such an arrangement. (auth)

6897
A HIGH-FREQUENCY CYCLOTRON WITH ONE DEE. R. Bock, A. Doehring, J. Jänecke, O. Knecht, L. Koester, H. Maier-Leibnitz, Ch. Schmelzer, and U. Schmidt-Rohr (Institut für Physik im Max-Planck-Institut für Medizinische Forschung, Heidelberg, German). Z. angew. Phys. 10, 49-55(1958) Feb. (In German)

A high-frequency cyclotron with only one dee is more versatile than cyclotrons with the more common two-dee system. The construction and characteristics of a single-dee cyclotron are discussed, and it is shown that high dee voltages and radiation intensities are obtained. (tr-auth)

Radiation Absorption and Scattering

6898 AFOSR-TN-58-136
Stanford Univ., Calif.
DETERMINANTAL APPROACH TO MESON-NUCLEON SCATTERING. Technical Report No. 26. M. Baker. Feb. 1958. 59p. Project No. 3750-37504. Contract AF18(600)-545. (AD-152163).

A treatment of scattering is presented where the construction of the scattering phase shifts is regarded as an energy-value problem. Using the relation between the phase shift and the energy shift, the phases can be obtained directly from the infinite determinant. For the problem of potential scattering this procedure is directly applicable and leads to results equivalent to the Fredholm solution of the scattering integral equation. However, for the case of interest, the interacting meson-nucleon system D(E) does not exist, and in order to apply this method, D(E) must be factored into convergent subdeterminants. From $D_1(E)$, the subdeterminant referring to a one-meson type state, the scattering phase shifts can be calculated. A procedure for constructing $D_1(E)$ for the meson-nucleon system is developed by using the formal structure of D(E). This method is then applied to calculate meson-nucleon scattering in the static model. $D_1(E)$ is expended in a power series. The first two terms of the expansion yield a solution for the phase shift similar to results given by the

Chew-Low one-meson approximation. Finally the result of a preliminary calculation with the fully relativistic interaction is discussed. (auth)

6899 INSJ-4
Tokyo Univ. Inst. for Nuclear Study.
THEORY OF DIRECT INTERACTION IN NUCLEON INELASTIC SCATTERING. Shiro Yoshida. Sept. 12, 1957. 51p.

For the inelastic scattering of nucleons at low and intermediate energies an approximate method is proposed by which the direct interaction process is calculated. From the coupled equation for the radial wave functions in various channels a standing wave solution is obtained by perturbation approximation. For the asymptotic form of the wave function in outgoing channel a proper form is chosen in such a way that the higher order contributions in perturbation expansion become small. The generalized K-matrix is calculated from the first order solution and later the S-matrix is transformed from the K-matrix. This method can give the exact solution in some simple cases and also is expected to give a good approximation in general cases. By assuming the simple zero-range force between nucleon in the nucleus and the incident neutron the approximate method is applied to the inelastic scattering of neutrons by Mg^{24}. The effect of the Pauli principle is also estimated. The same process is calculated by assuming the collective excitation and both results are compared. (auth)

6900 INSJ-5
Tokyo Univ. Inst. for Nuclear Study.
DIRECT AND COMPOUND PROCESSES IN NUCLEAR REACTIONS. M. Sano, T. Terasawa, and S. Yoshida. Sept. 12, 1957. 29p.

The elastic and inelastic scattering of nucleons by nuclei are investigated taking account of the direct process and the compound process. First, a few channels which are strongly coupled to the entrance channel are chosen and also the potential matrix is introduced, which describes the interaction among chosen channels and the distortion of the wave in each channel. Then the transition matrix element is written as a sum of two contributions, one from the direct process and the other from the compound process. The average cross section is also divided into two parts, whose interference term vanishes by choosing suitable potential matrix. The cross section of the direct process has a stronger energy dependence than the single particle resonance behavior. The compound cross section, which is the contribution from nearby levels and can be calculated if the potential matrix is known, is shown to have a form of the conventional statistical model with the modified definition of the transmission factor. (auth)

6901 NP-6623
Pennsylvania. Univ., Philadelphia.
ENERGY AND ANGULAR DISTRIBUTIONS OF PHOTOPROTONS FROM NITROGEN-15. Technical Report No. 3. Jacob L. Rhodes. Feb. 1958. 116p. Contract Nonr-551(17).

Nitrogen gas, enriched 95.7% in the isotope N^{15}, was exposed to betatron bremsstrahlung of 18.7 and 24.6 Mev maximum energy, and the photoprotons resulting from the reaction $N^{15}(\gamma,p)C^{14}$ were detected in nuclear emulsions. The energy and angular distributions of the protons were determined as were the photoproton yield and cross section. The yield with 18.7 Mev bremsstrahlung was $2.06\ (\pm 0.3) \times 10^4$ protons/atomic weight/roentgen, while the yield with 24.6 Mev bremsstrahlung was $1.06\ (\pm 0.14) \times 10^5$ protons/atomic weight/roentgen. The integrated cross section from threshold up to 24.6 Mev for photoprotons in which the residual nucleus is left in its ground state was 14.5 (±1.5) Mev-mb, while the integrated cross section over the same energy range for transitions in which the residual nucleus is left in excited states was 24 (±5) Mev-mb, giving a total photoproton cross section over this energy interval of 38 (±5) Mev-mb. In addition to the "giant resonance" extending from 19 to 24 Mev with integrated cross section equal to 10.3 Mev-mb the cross section vs. photon energy curve for ground state transitions shows small peaks at 11.6 Mev, at 15 Mev, and at 18.6 Mev, with integrated cross sections of 0.80, 1.47, and 0.75 Mev-mb respectively. A narrow peak at 20.5 Mev in the "giant resonance" region has an integrated cross section of about 0.5 Mev-mb. The angular distributions of the various proton groups fit curves of the form $A + \sin^2\theta\ (1 + \beta\cos\theta)^2$. The assymetry coefficient is approximately equal to 0.3. For protons of energy less than 9 Mev, the ratio A/B is found to be consistent with calculated distributions of protons emitted from isolated energy levels in the target nucleus. For protons of energy greater than 9 Mev a predominantly $\sin^2\theta$ distribution was found; the reduced isotropic component observed in the angular distribution of these protons is attributed to interference in s-wave and d-wave protons emitted from overlapping states accessible by electric dipole absorption in N^{15}. (auth)

6902 AEC-tr-2346
ATOMIC FACTORS OF ELECTRON SCATTERING. B. K. Vaynshteyn [Vainshtein]. Translated from Zhur. Eksptl'. i Teoret. Fiz. 25, 157-68(1953). 19p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 9-2033.

6903
ON THE MAGNETIC SCATTERING OF THERMAL NEUTRONS NEAR THE CURIE POINT OF A FERROMAGNETIC OR ANTIFERROMAGNETIC MATERIAL. M. A. Krivoglaz (Inst. of Physics in Metals, Academy of Sciences, Ukrainian SSR). Doklady Akad. Nauk. S.S.S.R. 118, 51-4(1958) Jan. 1. (In Russian)

6904
ELASTIC SCATTERING OF GAMMA-RAYS. N. Cindro and K. Ilakovac (Inst. of "Rudjer Boskovic", Zagreb). Nuclear Phys. 5, 647-52(1958) Mar.

Measurements of elastic scattering of 0.66, 1.12, and 1.33 Mev gamma rays from medium and heavy nuclei, designed to investigate energy and Z dependence, are described and their results presented. (auth)

6905
ON THE POSSIBILITY OF AN EXPERIMENTAL TEST OF DISPERSION RELATIONS FOR γ–PROTON SCATTERING. M. Cini (Istituto di Fisica dell'Università, Rome) and R. Stroffolini (Istituto di Fisica dell'Università, Turin). Nuclear Phys. 5, 684-92(1958) Mar.

The possibility of arriving at an experimental test of the dispersion relations for γ–proton scattering in a sufficient reliable way, such that any observed discrepancy would be considered a proof against dispersion relations, is investigated. It is found that immediately above the threshold for pion photoproduction the best conditions are found, because the forward cross section has a minimum, and its theoretical value is mainly determined by the dispersion integral containing the total photoproduction cross sections for unpolarized γ's. (auth)

6906
MULTIPLE SCATTERING MEASUREMENTS IN NUCLEAR EMULSIONS. S. Rosendorff and Y. Eisenberg (Weizmann Inst. of Science, Rehovoth, Israel). Nuovo cimento (10) 7, 23-38(1958) Jan. 1.

The practical use of the new multiple scattering function,

cos $\eta\varphi$, introduced by Lipkin et al., was examined by comparing its theory with experiment. At the same time the mean absolute angle according to Molière's scattering theory was compared with experiment for the second and third difference and the respective dispersions were determined experimentally. (The theoretical dispersion diverges in Molière's theory.) A good agreement between theory and experiment was obtained in the cosine case, both for the mean value and the dispersions, as well as in the mean absolute angle case with cut-off. Writing the relative error of $p\beta$ as $D_{2,3}/\sqrt{n}$ (for the second and third differences, respectively) we have obtained in the cosine case: $D_2 = 0.976$ and $D_3 = 1.36$, and in the mean absolute angle case (with cut-off at $4 < |\varphi| >$): $D_2 = 0.97$ and $D_3 = 1.37$. It is shown that, provided one restricts oneself to a certain class of estimates of $p\beta$, the above dispersion values are close to the minimum possible dispersion of $p\beta$. Also, an explanation is suggested for the known experimental fact that the ratio of the scattering constants K_3/K_2 is higher by a few percent than the expected value $\sqrt{8}$. (auth)

6907

DISPERSION RELATIONS FOR MOMENTUM TRANSFER HEAVY MESON-NUCLEON SCATTERING. D. Amati (Universidad de Buenos Aires) and B. Vitale (Istituto di Fisica dell'Università and Centro Siciliano di Fisica Nucleare, Catania, Italy). Nuovo cimento (10) 7, 190-9 (1958) Jan. 16.

6908

RELATIVISTIC ELECTRON-PROTON SCATTERING ACCORDING TO MESON THEORY. L. K. Pandit (Seminar fur theoretische Physik der Universität, Zurich). Nuovo cimento (10) 7, 263-5(1958) Jan. 16.

Scattering of high-energy electrons by protons, for electron energies ranging up to 550 Mev, has recently been measured. The experimenters were able to account for their experimental results on the basis of phenomenological models describing the proton as having an extended charge and magnetic moment distribution. The experiments quite definitely establish the extended structure of the proton. The results of the first-order perturbation calculations for electron-proton scattering are described. (A.C.)

6909

INELASTIC MAGNETIC SCATTERING OF NEUTRONS AT HIGH TEMPERATURES. P. G. de Gennes (Centre d'études Nucléaires de Saclay, France). Phys. and Chem. Solids 4, 223-6(1958).

The magnetic inelastic scattering of neutrons by paramagnetic media with exchange interactions has been studied, using the time-dependent spin correlation functions introduced by Van Hove. It is found that the even moments of the energy transfer depend strongly on momentum transfer (for small momentum transfer, all moments go to zero), and the state of the scatterer (single crystal or powder). The shape and half-width of the spectrum are given as functions of the scattering angle for a polycrystal with nearest-neighbor interactions. The whole study has been confined to the high-temperature region. (auth)

6910

ANGULAR DISTRIBUTION OF NEUTRONS SCATTERED BY THE 2.80-kev RESONANCE IN SODIUM. R. C. Block (Oak Ridge National Lab., Tenn.). Phys. Rev. 109, 1217-18(1958) Feb. 15.

The angular distribution of neutrons scattered by the 2.80-kev resonance in sodium has been measured with a pile beam and various combinations of boron and sodium filters. This distribution is found to be isotropic to within 10%. (auth)

6911

SEMIPHENOMENOLOGICAL TWO-NUCLEON POTENTIAL. P. S. Signell and R. E. Marshak (Univ. of Rochester, N. Y.). Phys. Rev. 109, 1229-39(1958) Feb. 15.

It is found that a good fit of the unpolarized and polarized two-nucleon scattering data up to 150 Mev can be obtained by adding a phenomenological short-range attractive spin-orbit potential to the meson-theoretic Gartenhaus potential (which contains both central and tensor terms). It is shown that the deep attractive wells which result for certain states can be modified so as to eliminate all undesirable bound states without hurting the fit with the scattering data (at least up to 150 Mev). The predictions of the combined Gartenhaus — spin-orbit potential are examined at 210 and 300 Mev. While the addition of a spin-orbit potential helps materially at these higher energies, it is likely that a precision fit of the 300-Mev scattering will require additional terms in the two-nucleon interaction (containing higher powers of the nucleon momentum than the first). (auth)

6912

NUCLEAR SCATTERING OF 40- AND 95-Mev PROTONS. A. E. Glassgold and P. J. Kellogg (Univ. of Minnesota, Minneapolis). Phys. Rev. 109, 1291-4(1958) Feb. 15.

An analysis of recent elastic scattering experiments with 40- and 95-Mev protons is presented in terms of a velocity-independent and central complex potential. A summary of this and previous work at lower energies is given also. (auth)

6913

OPTICAL-MODEL ANALYSES OF SCATTERING OF 4.1-, 7-, AND 14-Mev NEUTRONS BY COMPLEX NUCLEI. F. Bjorklund and S. Fernbach (Univ. of California, Livermore). Phys. Rev. 109, 1295-8(1958) Feb. 15.

Exact phase-shift calculations were carried out on the UNIVAC for the scattering of fast neutrons by complex nuclei. Both central and spin-orbit potentials are included. At each energy considered, a single set of parameters was found to give fairly good agreement with experimental data. (auth)

6914

π^- – PROTON SCATTERING AT 950 Mev. A. R. Erwin, Jr. and J. K. Kopp (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 109, 1364-6(1958) Feb. 15.

Approximately 1200 π^- – proton interactions in a liquid hydrogen bubble chamber were studied to obtain the elastic differential cross section and inelastic partial cross sections at 950 ± 20 Mev mean laboratory energy. Relative cross sections were converted to absolute values using the total cross section obtained by Cool and co-workers with counters. The differential cross section is inconsistent with a resonance of definite total angular momentum and parity and can be fitted by a superposition of partial waves of angular momenta up to $3\hbar$ without spin-flip scattering. In the center-of-mass system, 30% of the pions scatter beyond a broad minimum of the cross section at 75°. (auth)

6915

MINAMI TRANSFORMATION FOR NUCLEON-NUCLEON SCATTERING. R. M. Ryndin and Ya. A. Smorodinskii (United Inst. for Nuclear Studies). Soviet Phys. JETP 5, 976-80(1957) Dec.

It is shown that for the case of nucleon-nucleon scattering there is no analog of the transformation of phases which, in the case of scattering of pions by nucleons, leaves the scattering cross section invariant. In the case of nucleon-nucleon scattering, a transformation consisting of a rotation of the spins does not yield a new set of phases which are physically meaningful. (auth)

6916

POLARIZATION CORRELATION IN NUCLEON-NUCLEON SCATTERING. A. G. Zimin. Soviet Phys. JETP 5, 996-1001(1957) Dec.

Equations are obtained for the polarization correlation in proton-proton scattering, taking into account four phases: $^1S_0$, $^3P_0$, $^3P_1$, $^3P_2$ and Coulomb interaction. A computation using phases for the isotropic states as obtained from scattering data shows that the Coulomb interaction plays an essential role for energies of 10 to 30 Mev. Polarization correlation can thus be used to give a more precise determination of the isotropic phases (which do not give rise to polarization), and to estimate other phases in the energy region in which they begin to appear. The scheme of experiments for measuring the polarization correlation and obtain the combinations of components of the polarization tensor which are measured in the experiments is also considered. (auth)

6917

APPLICATION OF CORRELATION POLARIZATION IN THE PHASE ANALYSIS OF p-p SCATTERING. A. G. Zimin. Soviet Phys. JETP 5, 1008-9(1957) Dec.

The phase analysis of three-fold scattering of 310-Mev protons by protons, carried out with the aid of previously derived four essential quantities for scattering matrix (the depolarization, the rotation of polarization, the scattering cross section, and the value of polarization), yields five groups of permissible phases. Hence, the four designated quantities do not constitute a complete set of experimental data. Supplementary experiments of three-fold scattering with the application of correlation polarization were undertaken for the single-valued phase analysis. (R.V.J.)

6918

POLARIZATION OF DEUTERONS IN ELASTIC SCATTERING. O. D. Cheishvili (Tbilisi State Univ.). Soviet Phys. JETP 5, 1009-11(1957) Dec.

The polarization of deuterons during their elastic scattering by nuclei was investigated. Results were obtained for double scattering of deuterons at various angles by various materials. Comparisons were made of carbon targets with deuteron energies of 156 Mev. (R.V.J.)

6919

CALCULATION OF THE LOCAL AND ANGULAR DISTRIBUTION OF PARTICLE FLOW IN MULTIPLE SCATTERING. Friedrich Lenz (Lehrstuhl für Elektronenoptik und Feinmechanik der TH, Aachen). Z. angew. Phys. 10, 31-4 (1958) Jan. (In German)

In the calculation of the distribution function (calculated by Fermi with neglect of the velocity loss and absorption in a small-angle approximation) as well as for the case in closed form, the coefficients for velocity loss and absorption are given by arbitrary empirical functions. (tr-auth)

Radiation Effects

6920

ANALYSIS OF THE EFFECT OF NUCLEAR RADIATION ON TRANSISTORS. J. J. Loferski (RCA Labs., Princeton, N. J.). J. Appl. Phys. 29, 35-40(1958) Jan.

The behavior of germanium transistors in nuclear radiation fields is predicted by combining transistor theory and the experimentally observed changes in irradiated semiconductors. It is shown that the decay of minority carrier lifetime τ in the base region usually controls the useful life of a transistor in a radiation field. Radiation induced changes of the conductivity place an ultimate limit on transistor life, but these changes occur at a much slower rate than those in τ. The analysis predicts the following: (a) α_{cb}^{-1} should be a linear function of bombardment time in a constant flux field; (b) p-n-p units should decay faster than n-p-n units; (c) for a given resistivity type and structure the decay rate is proportional to the square of the transistor base width which in turn, is inversely proportional to the cutoff frequency of the amplification factor. Thus, high-frequency units with their thin base regions decay more slowly than low-frequency units. The predictions of the theory are compared with experimental observations on the behavior of irradiated transistors, and the agreement is found to be reasonably good. (auth)

6921

MAGNETIC SUSCEPTIBILITY OF NEUTRON-IRRADIATED QUARTZ. D. K. Stevens, W. J. Sturm, and R. H. Silsbee (Oak Ridge National Lab., Tenn.). J. Appl. Phys. 29, 66-8 (1958) Jan.

Measurements are reported of the magnetic susceptibility of neutron irradiated quartz as a function of irradiation time. The results are interpreted in terms of the density of centers produced by the irradiation and are compared with optical and x-ray studies of neutron damaged quartz. (auth)

6922

INFLUENCE OF IRRADIATION ON CREEP. Gunther Schoeck (Westinghouse Electric Co., Pittsburgh). J. Appl. Phys. 29, 112(1958) Jan.

6923

COMPARISON OF ELECTRON WITH NEUTRON IRRADIATION OF α-BRASS. A. C. Damask (Frankford Arsenal, Philadelphia). Phys. and Chem. Solids 4, 177-81(1958).

The decrease in electrical resistivity of α-brass which arises from increased short-range order is used as a measure of migration of excess vacancies during neutron and electron irradiation. It is shown that irradiation by 2 Mev electrons from a Van de Graaff generator will decrease the resistivity at the same rate as irradiation in the BNL reactor. However, theoretical estimates indicate that about fourteen times more vacancies are produced by the electron than by the neutron irradiation. The results demonstrate, however, that electron irradiation, although less efficient, is a feasible method for enhancing order in an alloy at temperatures well below those at which ordering can be achieved by thermal annealing alone. (auth)

Radioactivity

6924

POLARIZATION OF ELECTRONS EMITTED IN β-DECAY. A. I. Alikhanov, G. P. Eliseiev, V. A. Lubimov, and B. V. Ershler (USSR Academy of Sciences, Moscow). Nuclear Phys. 5, 588-94(1958) Mar.

In connection with a reconsideration of the law of conservation of parity some experiments have been performed with the purpose of detecting longitudinal polarization of electrons emitted in β decay. It was found that the spin of the emerging β electrons is opposite to the direction of electron motion. The magnitude of the longitudinal polarization agrees with the theoretical value, ν/c, ν being the electron velocity. (auth)

6925

STUDY ON α RADIOACTIVITY IN LOW CONCENTRATION. R. Dugnani Lonati, U. Facchini, and I. Iori (Lab. CISE, Milan); F. G. Houtermans (Physikalisches Institut der Universität, Bern); and E. Tongiorgi (Istituto di Paletnologia dell'Università, Pisa, Italy). Nuovo cimento (10) 7, 133-41 (1958) Jan. 16.

With an ionization chamber filled with Ar (98%) and N_2 (2%) and with an emitting surface of 1,100 cm^2 it is possible to analyze, by means of their α spectrum, samples of radioactive material containing concentrations of up to about 10^{-4}

units. These investigations are interesting, for instance, in the study of the age of a mineral deposit or a fossil and in the study of ocean sediments and of the radioactivity of lava. (auth)

6926

ON THE PURSEY-PAULI INVARIANTS IN THE THEORY OF BETA DECAY. G. Lüders (Univ. of California, Berkeley). Nuovo cimento (10) 7, 171-89(1958) Jan. 16.

The assumption of a vanishing neutrino mass leads to a group of transformations on the neutrino field which transform the β-decay interaction into equivalent interactions. By physical observations one cannot distinguish between equivalent interactions. The results of observations can be expressed in terms of nuclear matrix elements and combinations of the coupling constants which are invariant under the group. These invariants have recently been put forward by Pursey and on a more general basis by Pauli. They are explored further in this paper. Their mathematics is studied and relations between them are established. The conditions for invariance with respect to reflections in space, charge conjugation, and time reversal are expressed in terms of these invariants. Interactions which conserve lepton charge and/or couple to only two components of the neutrino field are characterized by relations between the invariants. In the Appendix possible experiments on β decay are expressed in terms of the invariants. (auth)

6927

BETA DECAY OF Ru^{103}. R. L. Robinson and L. M. Langer (Indiana Univ., Bloomington). Phys. Rev. 109, 1255-7 (1958) Feb. 15.

In an earlier investigation, the intense inner beta spectrum of Ru^{103} was observed by Kondaiah to have an anomalous shape corresponding to a deficiency of electrons at low energy. This shape could not be explained by the generally accepted theory of beta decay. By use of a 4π beta-ray scintillation spectrometer, this beta group has been studied in coincidence with the 495-kev gamma ray. The Fermi plot of the data is now found to be linear down to 37 kev. The beta spectrum in coincidence with the 610-kev gamma ray was also measured. By a comparison of the total decay energies of the inner beta groups and their cascading gamma rays, it is deduced that the 610- and 495-kev gamma rays decay to the same energy level of Rh^{103}. The end-point energies of the two beta groups measured in coincidence with the 495- and 610-kev gamma rays are, respectively, 227 ± 4 and 119 ± 4 kev. (auth)

6928

ELECTRON-CAPTURE DECAY OF Pu^{237}. D. C. Hoffman and B. J. Dropesky (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 109, 1282-90(1958) Feb. 15.

The conversion and K-Auger electron spectra of Pu^{237} (produced by alpha bombardment of U^{235}) were examined with a permanent-magnet spectrograph and a solenoidal beta-ray spectrometer. The photon spectrum was studied with scintillation spectrometers and the following intensity ratios were determined: K x-radiation: L x-radiation: 59.6-kev gamma radiation = 1.00 : 0.75 : 0.14. Data from the beta-ray and scintillation spectrometers were used to calculate a K-Auger electron coefficient of 0.06 ± 0.01 for Z = 93. Coincidence measurements established the existence of both K- and L-electron capture to the 59.6-kev level of Np^{237}. The ratio of L to K capture to that level was found to be 2.8, and from this ratio a total electron-capture decay energy of 0.21 Mev was calculated for Pu^{237}. This value is in good agreement with that of 0.22 Mev estimated from closed decay-energy cycles. The experimental data indicate that the principal branches of electron-capture decay are to the 59.6-kev (15%) and the 33.2-kev (22%) levels, and to the ground state (60%) of Np^{237}, with corresponding log ft values of 6.8, 6.9, and 6.8, respectively. (auth)

6929

THE DECAY OF THE NUCLIDES ^{75}Se AND ^{75}Ge. H. J. Van Den Bold, J. Van De Geijn, and P. M. Endt (Fysisch Laboratorium der Rijksuniversiteit, Utrecht). Physica 24, 23-38 (1958) Jan.

Gamma transitions in the decay of the nuclides Se^{75} and Ge^{75} have been investigated by scintillation spectroscopy. Single spectra and coincidence spectra were found to conform with the level schemes constructed by previous authors. Directional correlations of five γ cascades have been measured. Polarization correlation measurements were performed on the 121 kev–280 kev and 136 kev–265 kev γ cascades. The following spins and parities have been assigned to levels in As^{75}: ground state $3/2^-$, 199 kev $1/2^-$, 265 kev $3/2^-$, 280 kev $5/2^-$, 304 kev $9/2^+$, 401 kev $5/2^+$. (auth)

6930

THE ALPHA DECAY OF Pu^{239}. G. I. Novikova, L. N. Kondrat'ev, Yu. P. Sobolev, and L. L. Gol'din. Soviet Phys. JETP 5, 832-5(1957) Dec.

The α spectrum of Pu^{239} has been investigated. Three new lines with energies 5064 ± 2, 4999 ± 5 and 4917 ± 5 kev and intensities (0.037 ± 0.005), (0.013 ± 0.005), and (0.005 ± 0.002) % have been detected. It is shown that the principal α line of Pu^{239} is related to the decay to an excited level of U^{235} having a spin of $^1/_2$. Three previously detected lines and two of the newly detected lines belong to the rotational band of this level. The existence of a metastable state of U^{235} with an excitation energy of ~3 kev is predicted. A doublet splitting parameter equal to a = −0.276 has been found. (auth)

Rare Earths and Rare-earth Compounds

6931

THE ANOMALOUS THERMAL EXPANSION OF SOME RARE EARTH METALS. B. S. Chandrasekhar (Westinghouse Research Labs., Pittsburgh). Acta Met. 6, 212-14 (1958) Mar.

The thermal expansion anomalies in gadolinium, terbium, and dysprosium are shown to be consistent with Zener's views on the exchange interaction between unfilled electron shells. The spin alignment in antiferromagnetic dysprosium is inferred. The possibility of extending the model to the actinide elements is suggested. (auth)

6932

EXCITED STATES OF Dy^{161}. C. W. McCutchen (Cavendish Lab., Cambridge, Eng.). Phys. Rev. 109, 1211-16(1958) Feb. 15.

The γ rays following β decay of Tb^{161} have been investigated with sodium iodide scintillation counters and with a xenon counter used with and without x-ray escape gating. Gamma rays of 74, 57, 49, and 26 kev were observed together with Dy x rays. From these data and γ, K x-ray coincidence measurements, rough estimates are obtained for the K conversion coefficients of the 74- and 57-kev transitions. Combination of the γ-ray intensities with conversion-electron intensities determined by Cork, Brice, Schmid, and Helmer yields K and L conversion coefficients for all the transitions once the normalization of conversion electron and γ-ray intensities has been assumed. Where comparison is possible these conversion coefficients agree with those determined from the x-ray and γ-ray measurements alone. The multipolarities seem largely compatible with the unified-model predictions of Nilsson.

There is a possibility of at least one highly retarded E1 transition. (auth)

6933

LOW-ENERGY NEUTRON RESONANCES IN Sm^{149}. H. Marshak and V. L. Sailor (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 109, 1219-21(1958) Feb. 15.

The total neutron cross section of Sm^{149} has been measured in the energy range from 0.06 to ~ 20 ev using a crystal spectrometer with resolution 0.17 μsec/meter. The Breit-Wigner parameters have been obtained for four of the larger resonances at energies of 0.0976 ± 0.0005, 0 870 ± 0.003, 4.93 ± 0.03, and 8.9 ± 0.1 ev. The radiation widths for these four resonances are, respectively, in units of 10^{-3} ev: 63.6 ± 1.0, 59.8 ± 1.0, 66.7 ± 3.0, and 66.6 ± 6.0. Other resonances were found at energies of 6.4 ± 0.1, 12.0 ± 0.5, 14.8 ± 0.5, and 17.0 ± 0.5 ev. (auth)

Spectroscopy

6934 IDO-16408

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

SCINTILLATION SPECTROMETRY—GAMMA-RAY SPECTRUM CATALOGUE. R. L. Heath. July 1, 1957. 183p. Contract AT(10-1)-205. $4.75(OTS).

A comprehensive catalogue was prepared of the response of a scintillation detector to the gamma spectrum of a number of individual nuclides. Applications of the data in gamma scintillation spectrometry are discussed. (C.H.)

6935 UCLA-397

California. Univ., Los Angeles. Atomic Energy Project.

THE KBr PELLET TECHNIQUE IN INFRARED SPECTROSCOPY. P. M. Kratz, G. V. Alexander, R. E. Nusbaum. June 17, 1957. 20p. Contract AT-04-1-GEN-12. $3.30(ph OTS); $2.40(mf OTS).

A vacuum press designed for use in the KBr pellet technique of sample preparation for infrared spectrophotometry is described and various aspects of the method and its application in this laboratory are discussed. (auth)

6936

ON SOME REGULARITIES IN THE STRUCTURE OF THE X-RAY EMISSION K SPECTRA OF TITANIUM IN TITANATES. E. E. Vainshtein, M. N. Bril, and I. B. Staryi (Vernadskii Inst. of Geochemistry and Analytical Chemistry). Doklady Akad. Nauk S.S.S.R. 117, 597-600(1957) Dec. 1. (In Russian)

Certain phenomena observed in the x-ray and optical absorption spectra are related to the crossing-over transitions of atomic electrons. The relative intensities of the selected lines in the x-ray absorption spectra responding to the direct and crossing-over electron transitions of the absorbing atom are strongly dependent on the atomic polarization of the complex. It is assumed that the same factor would also affect the relative intensity of the corresponding emission lines. Experiments were made to confirm the above conclusions. The K_β line in the x-ray emission spectra of titanium in brookite, anatase, and titanates of Mg, Ca, Sr, Ba, Fe, and Zn were investigated. (R.V.J.)

6937

Hfs ANOMALY OF Sb^{121} AND Sb^{123} DETERMINED BY THE ELECTRON NUCLEAR DOUBLE RESONANCE TECHNIQUE. J. Eisinger and G. Feher (Bell Telephone Labs., Inc., Murray Hill, N. J.). Phys. Rev. 109, 1172-83(1958) Feb. 15.

The ratios of the hyperfine interaction constants "a" and the nuclear g factors of the stable isotopes of antimony have been measured. From these measurements the hyperfine structure anomaly, defined as $\Delta = (a_{121}/a_{123})(g_{123}/g_{121})-1$, was found to be $(-0.352 \pm 0.005)\%$. Δ has its origin in the difference in the spatial distribution of the nuclear magnetic dipole for the two isotopes, which is related to the structure of the two nuclei. The experimental result is compared with theoretical values of Δ based on a variety of nuclear models. The determination of a_{121}/a_{123} makes use of the electron nuclear double resonance technique (ENDOR) which is discussed in some detail. The sample used in the experiment was silicon doped with antimony and the microwave resonances were observed at ~ 9000 Mc/sec at a temperature of 1.2°K. The ratio of the nuclear g factors was determined by conventional nuclear magnetic resonance techniques. (auth)

Theoretical Physics

6938 AEC-tr-2836

ON THE LINEARIZATION OF HARTREE'S EQUATION. P. S. Zyrianov and V. M. Eleonskii. Translated from Zhur. Eksptl'. i Teoret. Fiz. 30, 592(1956). 3p.

Collective interactions can be described by linearization of Hartree's equation for solutions with constant density. The advantage of this description is that it admits a formulation of the boundary problem of an isolated system of interacting particles, occupying a limited region of space. In particular, the problem of free surface oscillations of heavy nuclei can be formulated within the framework of the equation, assigning a potential of interaction between the nucleons. The effect of symmetry of the wave function on the dispersion equations is also considered. (J.S.R.)

6939

STRONG COUPLING. Luis Maria Garrido (Junta de Energia Nuclear, Div. de Fisica, Madrid). Anales real soc. espaff. fís. y quím. (Madrid) Ser. A. 50, 217-28(1957) Nov.-Dec. (In Spanish)

The discovery of new strange particles and their decay necessitates the development of new techniques to deal with strong-coupling interactions. A completely covariant formulation of and a partial solution to the problem of strong coupling are presented. (auth)

6940

ON THE DETERMINATION OF THE NUCLEAR PAIR CORRELATION FUNCTION FROM THE HIGH ENERGY PHOTO-EFFECT. Kurt Gottfried (Harvard Univ.). Nuclear Phys. 5, 557-87(1958) Mar.

In accordance with Levinger's predictions, the absorption of a high energy photon frequently results in the simultaneous ejection of a neutron and proton. The present paper provides a theoretical analysis of this direct reaction which starts from first principles and is based on the following assumptions: (i) the impulse and closure approximations are valid, (ii) the photo-nuclear interaction is a sum of two-nucleon operators, and (iii) the pair correlation function is given by $\theta_s(r_1, r_2)|g(r_1-r_2)|^2$ where θ_s is the shell model correlation function and $g(x)$ contains those correlations directly due to nuclear forces. The cross section is then shown to be proportional to the probability for finding two nucleons with a certain total momentum in a relative S-state, the contributions from P-states being demonstrably small. The further assumptions required to relate the nuclear cross section to the one for photodissociation of deuterium are examined, while final state interactions are treated with an optical model. The theory is compared with the present data and found to be in good agreement. The type of further information required for ascertaining the validity of assumptions (ii) and (iii) is discussed, and a method for acquiring it suggested. (auth)

6941

ON THE MOTION OF CHARGED PARTICLES IN THE COMPLEX-SYMMETRIC UNIFIED FIELD THEORY. J. Moffat (Imperial Coll., London). Nuovo cim. nto (10) 7, 107-9 (1958) Jan. 1.

In the complex symmetric unified theory the equations of motion of charged particles were derived from the field equations by an application of the Einstein, Infeld, and Hoffman approximation method and the technique of deriving equations of motion introduced by Infeld. These equations of motion contained the Lorentz force. However, at each stage of approximation in the general theory, the equations of motion proved to be incompatible. In the present paper it is pointed out that by taking into account the conditions of integrability of the field equations this incompatibility is removed. In the first treatment of this problem a source tensor expressed linearly in terms of the Dirac δ-function is used. The conditions of integrability of these field equations can be taken into account—and the incompatibility removed—by applying the dipole procedure introduced recently by Infeld and Plebanski. The new treatment is based on the complex symmetric field equations of empty space. (A.C.)

6942

ON THE SYMMETRICS OF DIRAC FIELDS. H. Rollnik (Freien Universität, Berlin). Nuovo cimento (10) 7, 249-50(1958) Jan. 16. (In German)

6943

ON THE LOCALITY OF β-INTERACTION. G. F. Dell' Antonio and P. Gulmanelli (Istituto di Fisiche dell' Università and Istituto Nazionale di Fisica Nucleare, Milan). Nuovo cimento (10) 7, 266-8(1958) Jan. 16.

6944

COVARIANT QUANTUM STATISTICS OF FIELDS. A. O. Barut (Syracuse Univ., N. Y.). Phys. Rev. 109, 1376-80 (1958) Feb. 15.

Relativistic formulas are derived for energy, momentum and number densities and distributions for systems of bosons and fermions from a covariant formulation of the statistics of fields. Charge, spin, and angular momentum statistics are discussed. (auth)

6945

THE DESCRIPTION OF COLLECTIVE MOTIONS IN TERMS OF MANY-BODY PERTURBATION THEORY. III. THE EXTENSION OF THE THEORY TO THE NON-UNIFORM GAS. J. Hubbard (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Proc. Roy. Soc. (London) A244, 199-211(1958) Mar. 11.

The theory previously developed and applied to calculate the correlation energy of a free-electron gas is extended in this paper to calculate the energy of an electron gas in a potential field. Two new features arise: (i) the introduction of a self-consistent field which is a generalization of the ordinary Hartree field; (ii) the occurrence of 'local field correction' effects. It is shown that the energy of the gas can be expressed in terms of the eigenvalues of a certain homogeneous integral equation and a stationary principle for these eigenvalues is given. The theory is applied to crystals and an approximate expression for the correlation energy of a metal is derived neglecting Lorentz-Lorenz corrections effects. (auth)

6946

ELEMENTARY RELATIVISTIC WAVE MECHANICS OF SPIN 0 AND SPIN $\frac{1}{2}$ PARTICLES. Herman Feshbach and Felix Villars (Massachusetts Inst. of Tech., Cambridge). Revs. Modern Phys. 30, 24-45(1958) Jan.

A unified picture of the relativistic single particle wave mechanics for both the spin 0 boson and the spin $\frac{1}{2}\hbar$ fermion is presented. The single particle equations discussed are the Klein-Gordon equation for spin 0, and the Dirac equation for spin $\frac{1}{2}\hbar$. The wave mechanics of these particles is discussed. The field theoretic interpretation, in which the wave equations give the equations of motion for field operators, is connected with the particle interpretation. (M.H.R.)

6947

INVESTIGATION OF A MODEL IN QUANTUM FIELD THEORY. V. G. Solov'ev (Inst. of Nuclear Problems, Academy of Sciences, USSR). Soviet Phys. JETP 5, 859-66(1957) Dec.

A model is considered in which a spinor field interacts with a pseudoscalar field, the classical pseudoscalar field being independent of the coordinates. Owing to the properties of the model the equations for the Green function are considerably simplified, and this makes it possible to find their exact solution. An investigation of the Green function is carried out. (auth)

6948

EQUATIONS WITH VARIATIONAL DERIVATIVES IN STATISTICAL EQUILIBRIUM THEORY. I. P. Bazarov (Moscow State Univ.). Soviet Phys. JETP 5, 872-82(1957) Dec.

Equations with variational derivatives for correlation functions have been derived. A method is developed for solving these for various systems in statistical equilibrium. A superposition theorem is derived for obtaining the correlation functions when the interaction between the particles of the system can be described as the sum of long and short range forces. (auth)

6949

ON THE NONLINEAR GENERALIZATION OF THE MESON AND SPINOR FIELD EQUATIONS. D. F. Kurdgelaidze (Moscow State Univ.). Soviet Phys. JETP 5, 941-6(1957) Dec.

Exact periodic solutions of the nonlinear generalized Klein-Gordon and Dirac equations are considered. The energy of the nonlinear classical meson field is compared with that derived from quantum theory. (auth)

6950

STATISTICAL THEORY OF SYSTEMS OF CHARGED PARTICLES WITH ACCOUNT OF SHORT RANGE FORCES OF REPULSION. I. P. Bazarov (Moscow State Univ.). Soviet Phys. JETP 5, 946-52(1957) Dec.

The free energy of an electrically neutral system of charged particles (ions) has been found by taking into account the repulsive forces between them. The general expression obtained for the free energy of such systems is applied to its calculation for a concrete form of long-range and short-range forces. (auth)

6951

PARAMAGNETIC RESONANCE AND POLARIZATION OF NUCLEI IN METALS. M. Ya. Azbel', V. I. Gerasimenko, and I. M. Lifshitz (Physico-Technical Inst., Academy of Sciences, Ukrainian, SSR). Soviet Phys. JETP 5, 986-96 (1957) Dec.

A theory of paramagnetic resonances in metals is constructed, based on the simultaneous solution of Maxwell's equations and the kinetic equation for the density operator. The resultant nuclear polarization is determined. It is shown that this polarization varies very slowly with depth, decreasing exponentially up to depths of 10^{-3} to 1 cm, which is the mean distance traversed by an electron between collisions involving spin reversal. It is found that paramagnetic resonance brings about selective transparency of metallic films. (auth)

6952
THE NATURE OF FIELD FLUCTUATIONS. M. M. Mirianashvili, V. V. Chavchanidze, and Yu. G. Mamaladze (Inst. of Physics, Academy of Sciences, Georgian SSR). Soviet Phys. JETP 5, 1005-6(1957) Dec.

A complex wave function in charged fields was studied in relation to the wave field interactions with a non-electromagnetic field. Analysis was made of the field function as essentially a Hamiltonian quaternion and as essentially a Dirac quaternion. A theory of particles possessing simultaneously three charges has been suggested as a new possibility in mesodynamics, due to the broadening of algebraic class of functions as field functions. A specific program of introducing field functions of a new algebraic class was outlined. (R.V.J.)

6953
SIMPLIFICATION OF THE EQUATIONS FOR THE DISTRIBUTION FUNCTION OF ELECTRONS IN A PLASMA. A. V. Gurevich (P. N. Lebedev Physics Inst., Academy of Sciences, USSR). Soviet Phys. JETP 5, 1006-7(1957) Dec.

6954
PHENOMENOLOGICAL STUDY OF THE EFFECT OF NONCONDUCTING MEDIUM IN QUANTUM ELECTRODYNAMICS. M. I. Ryazanov (Moscow Engineering-Physics Inst.). Soviet Phys. JETP 5, 1013-15(1957) Dec.

6955
TWO POSSIBLE SCHEMES OF NONCONSERVATION OF PARITY IN WEAK INTERACTIONS. B. L. Ioffe. Soviet Phys. JETP 5, 1015-17(1957) Dec.

6956
NONCONSERVATION OF PARITY AND HYPERON DECAY. S. G. Matinyan (Inst. of Physics, Academy of Sciences, SSR). Soviet Phys. JETP 5, 1017-18(1957) Dec.

Studies were made of the decay of hyperons by interactions which do not conserve spatial parity. The investigations are restricted to hyperon spins equal to $\frac{1}{2}$ and nonderivative couplings. (R.V.J.)

6957
ON QUASICLASSICAL SINGLE-ELECTRON WAVE FUNCTIONS. N. I. Zhirnov (Moscow State Pedagogical Inst.). Soviet Phys. JETP 5, 1021-3(1957) Dec.

Approximate wave functions were constructed for an electron in bound states which allow for the electrostatic screening effect of the atomic electrons on the radiating electron. The calculations were based on the combination of the Fermi-Thomas statistical method and the generalized quasiclassical method of calculating wave functions in a given potential field. (R.V.J.)

6958
RADIATION FROM A POINT CHARGE, MOVING UNIFORMLY ALONG THE SURFACE OF AN ISOTROPIC MEDIUM. A. I. Morozov (Moscow State Univ.). Soviet Phys. JETP 5, 1028-9(1957) Dec.

6959
PHOTON GREEN FUNCTION ACCURATE TO e^4. S. N. Sokolov (Joint Inst. of Nuclear Study). Soviet Phys. JETP 5, 1029-30(1957) Dec.

6960
THE INFLUENCE OF ELECTRON POLARIZATION ON THE EFFECTIVE CROSS SECTION FOR PAIR ANNIHILATION IN FLIGHT. W. R. Theis. Z. Physik 150, 198-200 (1958). (In German)

The spin dependence of pair annihilation in flight was calculated, which offers a possibility for the measurement of positron spin. (tr-auth)

Tritium and Tritium Compounds

6961 CERN-58-2
European Organization for Nuclear Research, Geneva.
TRITIUM PRODUCTION IN IRON BY PROTONS AT ENERGIES BETWEEN 50 AND 177 MEV. K. Goebel. Feb. 1, 1958. 17p.

Tritium produced in iron by high energetic protons was separated from the target material and its activity determined with a GM counter. The tritium production by protons between 50 and 177 Mev was compared with the Na^{24}-activity in Al foils induced by the same proton beam. A cross-section of 6.6 mb at 177 Mev was obtained, at the lower energies the tritium yield decreases slowly and is about 4 mb at 50 Mev. These results can be compared with the prediction of the evaporation theory. It turns out that the evaporation effect does not explain the magnitude of the observed tritium cross-section. The possibility of other production mechanisms such as fast fragmentation and double pick-up process is described and other experiments in this field are discussed. (auth)

Uranium and Uranium Compounds

6962 AERE-M/M-182
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE EXAMINATION OF URANIUM–MOLYBDENUM AND URANIUM–NIOBIUM ALLOYS FOR IRRADIATION TESTS. J. R. Murray and F. L. Jagger. Dec. 1957. 14p.

Additions of 8 wt. % molybdenum or 10 wt. % niobium were required to stabilize the gamma phase in binary uranium-base alloys on quenching to room temperature. The preparation and metallographic examination of ten uranium alloy specimens for irradiation tests are described. (auth)

6963 CRC-738
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
THE THERMAL NEUTRON CAPTURE CROSS SECTION AND THE RESONANCE CAPTURE INTEGRAL OF U^{236}. M. J. Cabell, T. A. Eastwood, and P. J. Campion. Jan. 1958. 22p. (AECL-551). $0.50(AECL).

The thermal neutron capture cross section and the resonance capture integral of U^{236} have been determined by an activation method. Assuming 36.5 barns for the thermal neutron capture cross section of Co^{59}, a value of $\sigma_{2200} = 5.5 \pm 0.3$ barns has been obtained for U^{236}. The resonance capture integral (from 0.5 ev to ∞) was found to be 257 ± 22 barns relative to 48.6 barns for Co^{59}. The half life of U^{237} has been determined as 162.04 ± 0.05 hours. (auth)

6964 IDO-16432
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
URANIUM FISSION STOICHIOMETRY. F. P. Vance. Jan. 6, 1958. 14p. Contract AT(10-1)-205. $0.50(OTS).

Equations are derived which relate burnup and fission product generation. The equations are based on the stoichiometric relationship between U^{235} fissioned by (n,γ) reaction and U^{236} produced by this reaction. A sample calculation is made. (J.S.R.)

6965 ISC-893
Ames Lab., Ames, Iowa.
CHARACTERISTICS OF THE SOLID STATE TRANSFORMATIONS IN URANIUM. Harold H. Klepfer and P. Chiotti. June 1957. 113p. Contract W-7405-eng-82. $2.50(OTS).

The purpose of the investigation was to determine the temperature dependence of the lattice parameters of U from room temperature to the melting point and to provide experimental data on the general characteristics and kinetics of the allotropic transformations in U. Toward this end high-temperature x-ray diffraction, electrical resistance, and sonic experimental techniques were employed. The data presented are interpreted in terms of the known physical, mechanical, and structural properties of the metal and are intended as a contribution toward the complete experimental and theoretical description of the allotropic transformation processes in pure U. (auth)

6966 LA-618(Del.)
Los Alamos Scientific Lab., N. Mex.
CRITICAL MASSES OF ENRICHED URANIUM HYDRIDES AND SOME RELATED MEASUREMENTS. C. P. Baker and M. G. Holloway. Feb. 3, 1947. Decl. with deletions Feb. 24, 1958. 40p. Contract W-7405-eng-36. $7.80 (ph OTS); $3.30 (mf OTS).

The critical masses of enriched U–H mixtures under various conditions was measured, using two assembly structures embodying safety devices. A table of critical masses of UH_{10} in various tampers is given. The neutron density distribution inside WC and BeO tampers were measured with several detectors. In addition, a measurement was made of $\overline{\nu\sigma_g}/\overline{\nu\sigma_f}$ for the UH_{10} spectrum of neutrons. The mean life of neutrons in a UH_{10} assembly tamped with BeO and WC was measured by means of the Rossi method. (auth)

6967 NP-6500
Nuclear Science and Engineering Corp., Pittsburgh.
A GUIDE TO THE CALCULATION OF CRITICALITY LIMITS FOR ENRICHED URANIUM. J. Chernick. Jan. 8, 1957. 15p. Contract 06-63380.

6968 WAPD-PWR-PMM-913
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
MINUTES OF URANIUM OXIDE PANEL MEETING. J. D. Eichenberg. Dec. 12, 1956. Decl. Mar. 21, 1957. 8p. $1.80 (ph OTS); $1.80 (mf OTS).

Recent progress in UO_2 development is reported, with particular emphasis placed on irradiation damage information. (J.E.D.)

6969
FINE STRUCTURE OF THE α-SPECTRA OF U^{234} AND U^{238}. B. A. Bochagov, A. P. Komar, and G. E. Kocharov (Leningrad Physico-Tech. Inst., Academy of Sciences, USSR). Soviet Phys. JETP 5, 1026-7(1957) Dec.

The fine structure of U^{234} and U^{238} α spectra was studied with a high sensitivity ionization chamber which had a half-width of 30 kev. The high sensitivity of the apparatus was achieved by reducing the circuit noise to 6.8 kev, and by using a specially developed electric collimator method. The results agree with the data obtained by other methods. (R.V.J.)

PATENTS

Biology

6970
METHOD OF CONDUCTING A PERSON BETWEEN A SAFE REGION AND A DANGEROUS REGION. H. A. Moulthrop (to U. S. Atomic Energy Commission). U. S. Patent 2,813,022. Nov. 12, 1957.

This invention relates to a method for conducting a person between a safe region and a dangerous or contaminated region so that he may work in the dangerous region without risk to himself or the hinderance of an attached tube, and without danger of contaminating the safe region. A safety suit in which a person is to work is connected by a thermoplastic tube, turned partially inside out, to a hole in the wall separating the dangerous region. The tube is sealed by pressure and separated into two parts at the seal, whereupon the person in the suit may move around freely in the dangerous area. When the person desires to exit the dangerous region, the parts of the tube are resealed, removing a portion of the tube at the seal, and the person leaves the hole where he entered, seals the tube to close the hole, and cuts his suit free from the tube. Bands of masking tape inside and outside of the tube at predetermined points simplify the pressure sealing of the tube at the desired points. This patent provides a simple, safe and economical method of freely working in a dangerous region.

Chemistry

6971
PRODUCTION OF THORIUM COMPOUNDS. J. M. Fletcher and G. J. Ashworth (to U. K. Atomic Energy Authority). British Patent 783,195. Nuclear Eng. 3, No. 24, 136(1958) Mar.

Crude thorium hydroxide is dissolved in excess nitric acid and the acid solution boiled to break down any phosphate complexes. The resulting aqueous solution, with nitric acid present in at least molar concentration, is subjected to organic solvent extraction with tributyl phosphate containing a non-polar organic solvent as diluent.

6972
RECOVERY OF URANIUM BY ION-EXCHANGE. T. V. Arden (to Permutit Co., Ltd.). British Patent 783,591/592. Nuclear Eng. 3, No. 24, 136(1958) Mar.

Uranium can be removed in the form of a complex anion from solutions containing uranium salts (sulfates or phosphates) by treatment with an anion-exchange material in salt form. The uranium complex is then removed by further ion exchange in an eluting solution, usually an acid solution of ammonium nitrate or a mixture of sodium chloride and sulfuric acid. This known process (B.P. 626,882) can be used for the recovery of uranium in the form of a complex uranyl sulfate anion which is preferentially absorbed even when present only in low concentrations. Now cobalticyanide may be present in the uranium-containing solution especially when the ore under treatment is also a gold ore and has previously been treated with a cyanide solution. The affinity of cobalticyanide for the resins used in recent years, i.e., those containing quaternary ammonium groups, is so great that it is absorbed and cannot be removed by normal eluting solutions, thus preventing uranium uptake. It has now been discovered that certain resins have the properties both of taking up cobalticyanide and of releasing it again on treatment with a suitable solution, so as to allow continuous re-use. The best resin for this purpose is one containing a predominance of ethylamine groups attached to side chains. Others mentioned are those having predominantly benzylamine, ethanolamine and diethanolamine groups (783,591). The recovery process may also be carried out by passing the uranium and cobalticyanide containing solution in contact with a separate mass of anion-exchange material in salt form (filter for cobalticyanide) which mass is replaced when it will no longer trap the cobalticyanide while the mass by which the uranium is removed is periodically eluted and regenerated (783,592).

6973

RECOVERY OF PLUTONIUM FROM SOLUTIONS CONTAINING IT. (to U. K. Atomic Energy Authority (U.S.A.)). British Patent 783,601. Nuclear Eng. 3, No. 24, 136(1958) Mar.

A method of separating plutonium (small amounts) from neutron-irradiated uranium (large quantities) must be of such simplicity and ease of operation as to lend itself readily to remote control. The method consists of removing plutonium from solutions containing it in a lower state of oxidation than the hexavalent form by treating the solution with a fluoride of low solubility in water and which has the property of absorbing the plutonium. The absorbed plutonium is then removed by treatment with a soluble oxalate, carbonate or bicarbonate. Examples of suitable fluorides are calcium fluoride, strontium fluoride, lanthanum fluoride and other rare earth fluorides. (auth)

6974

RECOVERY OF THORIUM FROM MONAZITE. R. W. Blundell (to U. K. Atomic Energy Authority). British Patent 783,628. Nuclear Eng. 3, No. 24, 136(1958) Mar.

The monazite is digested with strong sulfuric acid at elevated temperature. The pasty mass obtained is cooled and added to a large volume of water, the temperature being kept below 30°C. The mixture is then filtered and the filtrate heated to about 45°C and treated with ammonia solution to precipitate light rare earth metal double sulfates. The resulting mixture is again filtered, the filtrate then containing the greater part of the thorium. (auth)

6975

PRODUCTION OF ALUMINIUM NITRIDE. J. C. Charlton and C. C. Evans (to U. K. Atomic Energy Authority). British Patent 784,126. Nuclear Eng. 3, No. 24, 136(1958) Mar.

When preparing aluminum nitride from its elements with the aid of a catalyst, a massive or lumpy product may be obtained which is extremely difficult to reduce to a powder. In order to produce the material in a readily crushable form, the mixture of finely divided aluminum of high purity and catalyst (particularly potassium hydrogen fluoride) is heated in an atmosphere of nitrogen gas at a temperature below the melting point of aluminum until reaction between the nitrogen and aluminum sets in. The temperature is then raised above the melting point of aluminum to complete the reaction.

6976

SEPARATION OF THE TRIVALENT RARE EARTHS. Werner Fischer, Gunter Siekemeier, Karl-Jurgen Bramekamp, and Gerhard Braune (to Th. Goldschmidt A. G., Essen, Germany). Canadian Patent No. 536,125. July 2, 1955.

A method is described for separating trivalent rare earths from their ores and crude mixtures. The trivalent rare earths are converted into their water-soluble salts and these salts are subjected to a liquid-liquid extraction between an aqueous phase and an immiscible organic liquid phase. (W.L.H.)

6977

PREVENTION OF SCALE FORMATION IN URANIUM SOLVENT EXTRACTOR. J. W. Delaplaine (to U. S. Atomic Energy Commission). U. S. Patent 2,812,232. Nov. 5, 1957.

A method for preventing the formation of scale in uranium solvent extraction apparatus is presented. The scale, consisting chiefly of precipitated silica and the sulfates of calcium and lead, may be prevented by a combination of measures, chiefly by prior heating and agitation to crystallize and remove silica, and by a maintenance of uranyl nitrate concentration in the feed and extractant above certain levels to increase the solubility of the calcium and lead sulfates.

6978

METAL EXTRACTION PROCESS. G. W. Lewis, Jr. and D. E. Rhodes (to U. S. Atomic Energy Commission). U. S. Patent 2,812,233. Nov. 5, 1957.

An improved method for extracting uranium from aqueous solutions by solvent extraction is presented. A difficulty encountered in solvent extraction operations using an organic extractant (e.g., tributyl phosphate dissolved in kerosene or carbon tetrachloride) is that emulsions sometimes form, and phase separation is difficult or impossible. This difficulty is overcome by dissolving the organic extractant in a molten wax which is a solid at operating temperatures. After cooling, the wax which now contains the extractant, is broken into small particles (preferably flakes) and this "wax complex" is used to contact the uranium bearing solutions and extract the metal therefrom. Microcrystalline petroleum wax and certain ethylene polymers have been found suitable for this purpose.

6979

URANIUM PURIFICATION PROCESS. J. R. Ruhoff and C. E. Winters (to U. S. Atomic Energy Commission). U. S. Patent 2,813,001. Nov. 12, 1957.

A process is described for the purification of uranyl nitrate by an extraction process. A solution is formed consisting of uranyl nitrate, together with the associated impurities arising from the HNO_3 leaching of the ore, in an organic solvent such as ether. If this were back extracted with water to remove the impurities, large quantities of uranyl nitrate will also be extracted and lost. To prevent this, the impure organic solution is extracted with small amounts of saturated aqueous solutions of uranyl nitrate thereby effectively accomplishing the removal of impurities while not allowing any further extraction of the uranyl nitrate from the organic solvent. After the impurities have been removed, the uranium values are extracted with large quantities of water.

6980

URANIUM PURIFICATION PROCESS. C. E. Winters (to U. S. Atomic Energy Commission). U. S. Patent 2,813,002. Nov. 12, 1957.

A method for the preparation of a diethyl ether solution of uranyl nitrate is described. Previously the preparation of such ether solutions has been difficult and expensive, since crystalline uranyl nitrate hexahydrate dissolves very slowly in ether. An improved method for effecting such dissolution has been found, and it comprises adding molten uranyl nitrate hexahydrate at a temperature of 65 to 105°C to the ether while maintaining the temperature of the ether solvent below its boiling point.

6981

ALKALINE CARBONATE LEACHING PROCESS FOR URANIUM EXTRACTION. A. Thunaes, E. A. Brown and A. T. Rabbitts (to U. S. Atomic Energy Commission). U. S. Patent 2,813,003. Nov. 12, 1957.

A process for the leaching of uranium from high carbonate ores is presented. According to the process, the ore is leached at a temperature of about 200°C and a pressure of about 200 p.s.i.g. with a solution containing alkali carbonate, alkali permanganate, and bicarbonate ion, the bicarbonate ion functioning to prevent premature formation of alkali hydroxide and consequent precipitation of a diuranate. After the leaching is complete, the uranium present is recovered by precipitation with NaOH.

6982

PROCESS FOR SEPARATING PLUTONIUM FROM IMPURI-

TIES. A. C. Wahl (to U. S. Atomic Energy Commission). U. S. Patent 2,813,004. Nov. 12, 1957.

A method is described for separating plutonium from aqueous solutions containing uranium. It has been found that if the plutonium is reduced to its 3+ valence state, and the uranium present is left in its higher valence state, then the differences in solubility between certain salts (e.g., oxalates) of the trivalent plutonium and the hexavalent uranium can be used to separate the metals. This selective reduction of plutonium is accomplished by adding iodide ion to the solution, since iodide possesses an oxidation potential sufficient to reduce plutonium but not sufficient to reduce uranium.

6983

PRODUCTION OF URANIUM. A. E. Ruehle and J. W. Stevenson (to U. S. Atomic Energy Commission). U. S. Patent 2,813,018. Nov. 12, 1957.

An improved process is described for the magnesium reduction of UF_4 to produce uranium metal. In the past, there have been undesirable premature reactions between the Mg and the bomb liner or the UF_4 before the actual ignition of the bomb reaction. Since these premature reactions impair the yield of uranium metal, they have been inhibited by forming a protective film upon the particles of Mg by reacting it with hydrated uranium tetrafluoride, sodium bifluoride, uranyl fluoride, or uranium trioxide. This may be accomplished by adding about 0.5 to 2% of the additive to the bomb charge.

6984

ISOTOPIC FRACTIONATION PROCESS OF URANIUM. A. Clark (to U. S. Atomic Energy Commission). U. S. Patent 2,813,064. Nov. 12, 1957.

A method for isotopic enrichment of uranium is presented. In electrolyzing an aqueous solution containing a mixture of U^{4+} and UO_2^{2+} ions, the lighter, more positively charged U^{4+} ions migrate towards the cathode faster than the UO_2^{2+} ions. If during the electrolysis, the electrolyte is flowed as a stream from the cathode to the anode at a velocity between the migration velocities of the two ions, the uranyl ions will be slowly washed downstream towards the anode, while the uranous ions will make headway towards cathode. It has unexpectedly been found that in the course of this process, the lighter isotope of uranium will concentrate in the UO_2^{2+} ions near the anode, while the heavier isotope will concentrate in the uranyl ions near the cathode.

6985

METHOD FOR REMOVAL OF LIGHT ISOTOPE PRODUCT FROM LIQUID THERMAL DIFFUSION UNITS. J. D. Hoffman and J. K. Ballou (to U. S. Atomic Energy Commission). U. S. Patent 2,813,598. Nov. 19, 1957.

A method and apparatus are described for removing the lighter isotope of a gaseous-liquid product from a number of diffusion columns of a liquid thermal diffusion system in two stages by the use of freeze valves. The subject liquid flows from the diffusion columns into a heated sloping capsule where the liquid is vaporized by the action of steam in a heated jacket surrounding the capsule. When the capsule is filled the gas flows into a collector. Flow between the various stages is controlled by freeze valves which are opened and closed by the passage of gas and cool water respectively through coils surrounding portions of the pipes through which the process liquid is passed. The use of the dual stage remover-collector and the freeze valves is an improvement on the thermal diffusion separation process whereby the fraction containing the lighter isotope may be removed from the tops of the diffusion columns without intercolumn flow, or prior stage flow while the contents of the capsule is removed to the final receiver.

6986

RETORT ASSEMBLY. C. C. Loomis and W. J. Ash (to U. S. Atomic Energy Commission). U. S. Patent 2,814,477. Nov. 26, 1957.

An improved retort assembly useful in the thermal reduction of volatilizable metals such as magnesium and calcium is described. In this process a high vacuum is maintained in the retort, however the retort must be heated to very high temperatures while at the same time the unloading end must be cooled to condense the metal vapors, therefore the retention of the vacuum is frequently difficult due to the thermal stresses involved. This apparatus provides an extended condenser sleeve enclosed by the retort cover which forms the vacuum seal. Therefore, the seal is cooled by the fluid in the condenser sleeve and the extreme thermal stresses found in previous designs together with the deterioration of the sealing gasket caused by the high temperatures are avoided.

6987

ION BEAM COLLIMATOR. A. S. Langsdorf, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,814,728. Nov. 26, 1957.

A device is described for defining a beam of high energy particles wherein the means for defining the beam in the horizontal and vertical dimension are separately adjustable and the defining members are internally cooled. In general, the device comprises a mounting block having a central opening through which the beam is projected, means for rotatably supporting two pairs of beam-forming members, passages in each member for the flow of coolant; the beam-forming members being insulated from each other and the block, and each having an end projecting into the opening. The beam-forming members are adjustable and may be cooperatively positioned to define the beam passing between the end of the members. To assist in projecting and defining the beam, the member ends have individual means connected thereto for indicating the amount of charge collected thereon due to beam interception.

6988

URANIUM PRECIPITATION PROCESS. A. Thunaes, E. A. Brown, H. W. Smith, and R. Simard (to U. S. Atomic Energy Commission). U. S. Patent 2,815,261. Dec. 3, 1957.

A method for the recovery of uranium from sulfuric acid solutions is described. In the present process, sulfuric acid is added to the uranium bearing solution to bring the pH to between 1 and 1.8, preferably to about 1.4, and aluminum metal is then used as a reducing agent to convert hexavalent uranium to the tetravalent state. As the reaction proceeds, the pH rises and a selective precipitation of uranium occurs resulting in a high grade precipitate. This process is an improvement over the process using metallic iron, in that metallic aluminum reacts less readily than metallic iron with sulfuric acid, thus avoiding consumption of the reducing agent and a raising of the pH without accomplishing the desired reduction of the hexavalent uranium in the solution. Another disadvantage to the use of iron is that positive ferric ions will precipitate with negative phosphate and arsenate ions at the pH range employed.

6989

SEPARATION PROCESS FOR THORIUM SALTS. G. L. Bridger, M. E. Whatley and K. G. Shaw (to U. S. Atomic Energy Commission). U. S. Patent 2,815,262. Dec. 3, 1957.

A process is described for the separation of uranium, thorium, and rare earths extracted from monazite by digesting with sulfuric acid. By carefully increasing the

pH of the solution, stepwise, over the range 0.8 to 5.5, a series of selective precipitations will be achieved, with the thorium values coming out at lower pH, the rare earths at intermediate pH and the uranium last. Some mixed precipitates will be obtained, and these may be treated by dissolving in HNO_3 and contacting with dibutyl phosphate, whereby thorium or uranium are taken up by the organic phase while the rare earths preferentially remain in the aqueous solution.

6990

PROCESSING OF MONAZITE SAND. G. D. Calkins and E. G. Bohlmann (to U. S. Atomic Energy Commission). U. S. Patent 2,815,264. Dec. 3, 1957.

A process for the recovery of thorium, uranium, and rare earths from monazite sands is presented. The sands are first digested and dissolved in concentrated NaOH, and the solution is then diluted causing precipitation of uranium, thorium and rare earth hydroxides. The precipitate is collected and dissolved in HCl, and the pH of this solution is adjusted to about 6, precipitating the hydroxides of thorium and uranium but leaving the rare earths in solution. The rare earths are then separated from the solution by precipitation at a still higher pH. The thorium and uranium containing precipitate is redissolved in HNO_3 and the two elements are separated by extraction into tributyl phosphate and back extraction with a weakly acidic solution to remove the thorium.

6991

METAL RECOVERY PROCESS. L. B. Werner and O. F. Hill (to U. S. Atomic Energy Commission). U. S. Patent 2,815,265. Dec. 3, 1957.

A process is presented for the separation of plutonium from the niobium oxide which is frequently used as a carrier precipitate to separate the plutonium from solutions of dissolved fuel elements. The niobium oxide, plutonium bearing precipitate is treated with hydrogen fluoride converting the niobium to the volatile pentafluoride, while the plutonium is changed into the substantially non-volatile plutonium tetrafluoride. After the niobium has been removed, the plutonium tetrafluoride is reacted with elemental fluorine, converting it to a higher plutonium fluoride and this may in turn be volatilized away from any residual impurities.

6992

METHOD OF PREPARING PuF_4. R. E. Heath and A. E. Florin (to U. S. Atomic Energy Commission). U. S. Patent 2,815,266. Dec. 3, 1957.

A method is presented for the preparation of plutonium tetrafluoride from plutonium trifluoride. This is accomplished by contacting the trifluoride with hydrogen fluoride in the presence of oxygen. The preferred temperature for the reaction is in the neighborhood of 600°C and the preferred reactant mixture consists of HF mixed with from 5 to 20 volume % of O_2.

6993

METHOD FOR REMOVING SODIUM OXIDE FROM LIQUID SODIUM. W. H. Bruggeman and B. G. Voorhees (to U. S. Atomic Energy Commission). U. S. Patent 2,815,277. Dec. 3, 1957.

A method is described for removing sodium oxide from a fluent stream of liquid sodium by coldtrapping the sodium oxide. Apparatus utilizing this method is disclosed in United States Patent No. 2,745,552. Sodium will remain in a molten state at temperatures below that at which sodium oxide will crystallize out and form solid deposits, therefore, the contaminated stream of sodium is cooled to a temperature at which the solubility of sodium oxide in sodium is substantially decreased. Thereafter the stream of sodium is passed through a bed of stainless steel wool maintained at a temperature below that of the stream. The stream is kept in contact with the wool until the sodium oxide is removed by crystal growth on the wool, then the stream is reheated and returned to the system. This method is useful in purifying reactor coolants where the sodium oxide would otherwise deposit out on the walls and eventually plug the coolant tubes.

6994

EXTRACTION OF URANYL NITRATE FROM AQUEOUS SOLUTIONS. N. H. Furman and R. J. Mundy (to U. S. Atomic Energy Commission). U. S. Patent 2,816,005. Dec. 10, 1957.

An improvement in the process is described for extracting aqueous uranyl nitrate solutions with an organic solvent such as ether. It has been found that the organic phase will extract a larger quantity of uranyl nitrate if the aqueous phase contains in addition to the uranyl nitrate, a quantity of some other soluble nitrate to act as a salting out agent. Mentioned as suitable are the nitrates of lithium, calcium, zinc, bivalent copper, and trivalent iron.

6995

METHOD OF RECOVERING THORIUM. R. W. Fisher (to U. S. Atomic Energy Commission). U. S. Patent 2,816,122. Dec. 10, 1957.

A method is described for recovering thorium from impurities found in a slag containing thorium and said impurities, comprising leaching a composition containing thorium with water, removing the water solution, treating the residue with hydrochloric acid, separating the solution from the insoluble residue, adjusting its acidity to 1 to 3 normal, adding oxalic acid, and thereafter separating the precipitated thorium oxalate digesting the residue from the hydrochloric acid treatment with a strong solution of sodium hydroxide at an elevated temperature, removing said solution and treating the insoluble residue with hydrochloric acid, separating the solution from the insoluble residue, adjusting the acidity of this solution to 1 to 3 normal, adding nitric acid to oxidize the iron present, adding oxalic acid and thereafter separating the thorium oxalate thus precipitated.

6996

FRACTIONAL DISTILLATION SEPARATION OF PLUTONIUM VALUES FROM LIGHT ELEMENT VALUES. B. B. Cunningham (to U. S. Atomic Energy Commission). U. S. Patent 2,816,813. Dec. 17, 1957.

A process is described for removing light element impurities from plutonium. It has been found that plutonium contaminated with impurities may be purified by converting the plutonium to a halide and purifying the halide by a fractional distillation whereby impurities may be distilled from the plutonium halide. A particularly effective method includes the step of forming a lower halide such as the tri- or tetrahalide and distilling the halide under conditions such that no decomposition of the halide occurs. Molecular distillation methods are particularly suitable for this process. The apparatus may comprise an evaporation plate with means for heating it and a condenser surface with means for cooling it. The condenser surface is placed at a distance from the evaporating surface less than the mean free path of molecular travel of the material being distilled at the pressure and temperature used. The entire evaporating system is evacuated until the pressure is about 10^{-4} millimeters of mercury.

6997

METHOD FOR SEALING THE PORES IN A CARBON BODY. M. C. Sanz, C. R. Malmstrom, J. M. Nuding and H. P. Yockey (to U. S. Atomic Energy Commission). U. S. Patent 2,817,605. Dec. 24, 1957.

A high temperature method is presented for sealing porous materials such as carbon or graphite that may be used as a support or a moderator in a nuclear reactor. The carbon body is subjected to two surface heats simultaneously in an inert atmosphere; the surface to be sealed is heated to 1500 degrees centigrade; and another surface is heated to 300 degrees centigrade, whereupon the carbon vaporizes and flows to the cooler surface where it is deposited to seal that surface. This method may be used to seal a nuclear fuel in the carbon structure.

6998

LIQUID-LIQUID EXTRACTION COLUMNS. J. D. Thornton (to U. S. Atomic Energy Commission). U. S. Patent 2,818,324. Dec. 31, 1957.

This patent relates to liquid-liquid extraction columns having a means for pulsing the liquid in the column to give it an oscillatory up and down movement, and consists of a packed column, an inlet pipe for the dispersed liquid phase and an outlet pipe for the continuous liquid phase located in the direct communication with the liquid in the lower part of said column, an inlet pipe for the continuous liquid phase and an outlet pipe for the dispersed liquid phase located in direct communication with the liquid in the upper part of said column, a tube having one end communicating with liquid in the lower part of said column and having its upper end located above the level of said outlet pipe for the dispersed phase, and a piston and cylinder connected to the upper end of said tube for applying a pulsating pneumatic pressure to the surface of the liquid in said tube so that said surface rises and falls in said tube.

6999

VELOCITY SELECTOR METHOD FOR THE SEPARATION OF ISOTOPES. R. J. Britten (to U. S. Atomic Energy Commission) U. S. Patent 2,818,507. Dec. 31, 1957.

A velocity selector apparatus is described for separating and collecting an enriched fraction of the isotope of a particular element. The invention has the advantage over conventional mass spectrometers in that a magnetic field is not used, doing away with the attendant problems of magnetic field variation. The apparatus separates the isotopes by selectively accelerating the ionized constituents present in a beam of the polyisotopic substance that are of uniform kinetic energy, the acceleration being applied intermittently and at spaced points along the beam and in a direction normal to the direction of the propagation of the uniform energy beam whereby a transverse displacement of the isotopic constituents of different mass is obtained.

7000

PLUTONIUM SEPARATION METHOD. J. L. Dreher and S. G. Thompson (to U. S. Atomic Energy Commission). U. S. Patent 2,819,143. Jan. 7, 1958.

An improved method is described for separating plutonium from fission product contaminants. The process consists in treating a cerium group trifluoride carrier precipitate containing reduced plutonium with an acidic solution containing ceric ion which causes the precipitate to be dissolved and oxidizes the plutonium to the hexavalent state. The plutonium containing solution is then contacted with a soluble alkali metal compound and a soluble fluoride which precipitates the rare earth and contaminant ions present but leaves the plutonium in solution. The precipitate is then removed leaving contaminant free plutonium bearing solution.

7001

SEPARATION OF PLUTONIUM FROM URANIUM AND FISSION PRODUCTS BY ADSORPTION. G. T. Seaborg and J. E. Willard (to U. S. Atomic Energy Commission). U. S. Patent 2,819,144. Jan. 7, 1958.

A method is presented for the separation of plutonium from solutions containing that element in a valence state not higher than 4^+ together with uranium ions and fission products. This separation is accomplished by contacting the solutions with diatomaceous earth which preferentially adsorbs the plutonium present. Also mentioned as effective for this adsorbtive separation are silica gel, fuller's earth and alumina.

7002

PLUTONIUM COMPOUNDS AND PROCESS FOR THEIR PREPARATION. F. J. Wolter and H. C. Diehl, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,819,280. Jan. 7, 1958.

This patent relates to certain new compounds of plutonium, and to the utilization of these compounds to effect purification or separation of the plutonium. The compounds are organic chelate compounds consisting of tetravalent plutonium together with a di(salicylal) alkylenediimine. These chelates are soluble in various organic solvents, but not in water. Use is made of this property in extracting the plutonium by contacting an aqueous solution thereof with an organic solution of the diimine. The plutonium is chelated, extracted and effectively separated from any impurities accompanying it in the aqueous phase.

7003

PURIFICATION PROCESS. H. L. Wibbles and E. I. Miller (to U. S. Atomic Energy Commission). U. S. Patent 2,819,944. Jan. 14, 1958.

This patent deals with the separation of uranium from molybdenum compounds, and in particular with their separation from ether solutions containing the molybdenum in the form of acids, such as silicomolybdic and phosphomolybdic acids. After the nitric acid leach of pitchblende, the molybdenum values present in the ore are found in the leach solution in the form of complex acids. The uranium bearing solution may be purified of this molybdenum content by contacting it with activated charcoal. The purification is improved when the acidity of the solution is low and agitation is also beneficial. The molybdenum may subsequently be recovered from the charcoal and the charcoal reused.

7004

PROCESS OF DISSOLVING ZIRCONIUM ALLOYS. R. S. Shor and S. Vogler (to U. S. Atomic Energy Commission). U. S. Patent 2,820,692. Jan. 21, 1958.

A process is described for dissolving binary zirconium–uranium alloys where the uranium content is about 2%. In prior dissolution procedures for these alloys, an oxidizing agent was added to prevent the precipitation of uranium tetrafluoride. In the present method complete dissolution is accomplished without the use of the oxidizing agent by using only the stoichiometric amount or slight excess of HF required by the zirconium. The concentration of the acid may range from 2M to 10M and the dissolution is advantageously carried out at a temperature of 80°C.

7005

METHOD OF SEPARATING FROTHS FROM LIQUIDS. G. P. Monet (to U. S. Atomic Energy Commission). U. S. Patent 2,820,759. Jan. 21, 1958.

A method for separating solids and precipitates from liquids is described. The method is particularly adapted for and valuable in processing highly radioactive solutions. It consists in essence, in employing the principles of froth flotation to effect the separation of approximately 99% of the solids present. An apparatus, consisting of a system of pipes, valves and vessels, for carrying out the process of this patent is also described therein.

Engineering

7006

ELECTRIC CABLES AND INSULATED WIRES. L. G. Brazier and R. M. Black (to British Insulated Callender's Cables, Ltd.). British Patent 784,161. Nuclear Eng. 3, No. 24, 136(1958) Mar.

Use of high energy radiation before soldering of cable fitting reduces risk of softening the body of the fitting.

7007

DIRECT CURRENT ELECTROMAGNETIC PUMP. A. H. Barnes (to U. S. Atomic Energy Commission). U. S. Patent 2,811,923. Nov. 5, 1957.

An improved d-c electromagnetic pump is presented in which the poles, and consequently the magnetic gap at the poles, are tapered to be wider at the upstream end. In addition, the cross section of the tube carrying the liquid metal is tapered so that the velocity of the pumped liquid increases in the downstream direction at a rate such that the counter-induced voltage in the liquid metal remains constant as it traverses the region between the poles. This configuration compensates for the distortion of the magnetic field caused by the induced voltage that would otherwise result in the lowering of the pumping capacity. This improved electromagnetic pump has practical application in the pumping of liquid metal coolants for nuclear reactors where conventional positive displacement pumps have proved unsatisfactory due to the high temperatures and the corrosive properties of the liquid metals involved.

7008

SEAL FOR ROTATING SHAFT. R. T. Coffman (to U. S. Atomic Energy Commission). U. S. Patent 2,815,968. Dec. 10, 1957.

A seal is described for a rotatable shaft that must be highly effective when the shaft is not rotating but may be less effective while the shaft is rotating. Weights distributed about a sealing disk secured to the shaft press the sealing disk against a tubular section into which the shaft extends, and when the shaft rotates, the centrifugal forces on the weights relieve the pressure of the sealing disk against the tubular section. This action has the very desirable result of minimizing the wear of the rotating disk due to contact with the tubular section, while affording maximum sealing action when it is needed.

7009

SEAL FOR HIGH SPEED CENTRIFUGE. C. W. Skarstrom (to U. S. Atomic Energy Commission). U. S. Patent 2,816,704. Dec. 17, 1957.

A seal is described for a high speed centrifuge wherein the centrifugal force of rotation acts on the gasket to form a tight seal. The cylindrical rotating bowl of the centrifuge contains a closure member resting on a shoulder in the bowl wall having a lower surface containing bands of gasket material, parallel and adjacent to the cylinder wall. As the centrifuge speed increases, centrifugal force acts on the bands of gasket material forcing them in to a sealing contact against the cylinder wall. This arrangement forms a simple and effective seal for high speed centrifuges, replacing more costly methods such as welding a closure in place.

7010

GAS METERING PUMP. C. M. George (to U. S. Atomic Energy Commission). U. S. Patent 2,818,208. Dec. 31, 1957.

A liquid piston gas pump is described, capable of pumping minute amounts of gas in accurately measurable quantities. The pump consists of a flanged cylindrical regulating chamber and a mercury filled bellows. Sealed to the regulating chamber is a valve head having a gas inlet and outlet, the inlet being connected by a helical channel to the bellows. A gravity check valve is in the gas outlet, so the gas passes through the inlet and the helical channel to the bellows where the pumping action as well as the metering is accomplished by the actuation of the mercury filled bellows. The gas then flows through the check valve and outlet to any associated apparatus.

7011

DEVICE FOR CONVEYING AND ROTATING OBJECTS. C. E. Frantz and J. Roslund (to U. S. Atomic Energy Commission). U. S. Patent 2,820,367. Jan. 21, 1958.

A device is described for conveying cylindrical material with a combined rotary and axial motion. The material rides on a series of balls which are retained in a guide plate and rotated by bearing against a rotating drum. The drum has a series of conical sections or grooves cut in its outer surface on which the balls ride. The grooves and balls match in such a way that all the balls are caused to rotate about an axis at an angle to the drum axis. This skewed rotation of the ball imparts a longitudinal as well as a rotary motion to the cylinders being conveyed.

7012

GO-DEVILS. S. Jefferson (to U. S. Atomic Energy Commission). U. S. Atomic Patent 2,821,636. Jan. 28, 1958.

This patent relates to a device normally termed a go-devil for use in clearing pipes of sludge, and in particular describes an arrangement for housing a radioactive source within a go-devil whereby the source is removed from a radioactivity shield for detection purposes only when the go-devil is in use. In the described go-devil the radioactive source is housed in a member attached to a piston. Under normal pressure conditions the piston is forced in a direction to position the source within a lead shield. A bellows senses the pressure external to the go-devil and acts through a hydraulic line to force the piston in a direction to remove the source from the shield as long as the pressure is above a pre-set value.

Mineralogy, Metallurgy, and Ceramics

7013

ZIRCONIUM TERNARY ALLOYS. (to U. K. Atomic Energy Authority (U.S.A.)). British Patent 783,646. Nuclear Eng. 3, No. 24, 136(1958) Mar.

A zirconium base ternary alloy containing 1 to 5 wt. % of niobium and 0.1 to 2% metals such as aluminum, Molybdenum or vanadium is reported, the weight percent of niobium present exceeding that of aluminum, molybdenum, or vanadium. Such alloy possesses the tensile characteristics at high temperatures of stainless steel and satisfactory ductility but has capture cross sections for thermal-neutrons less than one-third the capture cross section of stainless steel.

7014

PROCESS OF PRODUCING REFRACTORY URANIUM OXIDE ARTICLES. N. E. Hamilton (to U. S. Atomic Energy Commission). U. S. Patent 2,814,849. Dec. 3, 1957.

A method is presented for fabricating uranium oxide into a shaped refractory article by introducing a uranium halide fluxing reagent into the uranium oxide, and then mixing and compressing the materials into a shaped composite mass. The shaped mass of uranium oxide and uranium halide is then fired at an elevated temperature so as to form a refractory sintered article. It was found in the present invention that the introduction of a uranium halide fluxing agent afforded a fluxing action with the uranium oxide particles and that excellent cohesion between these

oxide particles was obtained. Approximately 90% of uranium dioxide and 10% of uranium tetrafluoride represent a preferred composition.

7015

CERAMIC FUEL ELEMENT MATERIAL FOR A NEUTRONIC REACTOR AND METHOD OF FABRICATING SAME. W. H. Duckworth (to U. S. Atomic Energy Commission). U. S. Patent 2,814,857. Dec. 3, 1957.

This patent relates to ceramic composition, and to neutronic reactor fuel elements formed therefrom. These ceramic elements have high density and excellent strength characteristics and are formed by conventional ceramic casting and sintering at a temperature of about 2700°F in a nitrogen atmosphere. The composition consists of silicon carbide, silicon, uranium oxide and a very small percentage of molybdenum. Compositions containing molybdenum are markedly stronger than those lacking this ingredient.

7016

REFRACTORY ARTICLE AND PROCESS OF MANUFACTURING SAME. N. E. Hamilton (to U. S. Atomic Energy Commission). U. S. Patent 2,816,042. Dec. 10, 1957.

A method is described for fabricating improved uranium oxide crucibles. In the past, such crucibles have lacked mechanical strength due to the poor cohesion of the uranium oxide particles. This difficulty has now been overcome by admixing with the uranium oxide a quantity of a refractory oxide binder, and dry pressing and sintering the resulting mixture into the desired shape. Suitable as binders are BeO, CaO, Al_2O_3, and ThO_2 among others.

7017

METHOD OF MAKING A REFRACTORY MATERIAL. H. I. Miller (to U. S. Atomic Energy Commission). U. S. Patent 2,818,605. Jan. 7, 1958.

This patent relates to a composition containing beryllia and the oxide of a fissile element such as uranium. The oxides are first ground and mixed, paraffin is added to the mixed powders, and the composition is then compacted and sintered to drive off the paraffin and produce a structually stable compact. The result is a coherent refractory arrangement of fissile nuclei dispersed among moderating nuclei. The composition, size, shape, etc., of the brick may be varied according to its intended use.

7018

PROCESS FOR PRODUCING JACKETED BODIES. H. A. Saller (to U. S. Atomic Energy Commission). U. S. Patent 2,820,751. Jan. 21, 1958.

A method is given for enclosing a metallic core within an outer protective jacket, such as in the production of fuel elements for neutronic reactors. The method comprises the steps of inserting the body of a first metal into an aperture in a frame of a second metal, placing a sheet of the second metal on each of opposite sides of the assembled body and frame, and bonding the sheets to the body and the frame and the body and the frame to one another.

7019

PROCESS OF COATING METALS WITH BISMUTH OR BISMUTH-BASE ALLOYS. J. G. Beach (to U. S. Atomic Energy Commission). U. S. Patent 2,821,505. Jan. 28, 1958.

A method is described for producing coatings of bismuth or bismuth alloys on a metal base. This is accomplished by electrodepositing the bismuth from an aqueous solution of $BiCl_3$, and by making the metal base alternately the cathode and the anode, the cathode periods being twice as long as the anode periods. In one embodiment a nickel coating is first electrodeposited in a known way, and this nickel plated piece is the base upon which the bismuth is deposited by the process of this patent. The coated piece is then heat treated to produce a homogeneous Ni–Bi alloy by diffusion.

Physics

7020

ATOMIC POWER PLANT. F. Daniels (to U. S. Atomic Energy Commission). U. S. Patent 2,812,303. Nov. 5, 1957.

This patent relates to neutronic reactor power plants and discloses a design of a reactor utilizing a mixture of discrete units of a fissionable material, such as uranium carbide, a neutron moderator material, such as graphite, to carry out the chain reaction. A liquid metal, such as bismuth, is used as the coolant and is placed in the reactor chamber with the fissionable and moderator material so that it is boiled by the heat of the reaction, the boiling liquid and vapors passing up through the interstices between the discrete units. The vapor and flue gases coming off the top of the chamber are passed through heat exchangers, to produce steam, for example, and thence through condensers, the condensed coolant being returned to the chamber by gravity and the non-condensible gases being carried off through a stack at the top of the structure.

7021

MEANS FOR COOLING REACTORS. J. A. Wheeler (to U. S. Atomic Energy Commission). U. S. Patent 2,812,304. Nov. 5, 1957.

A design of a reactor is presented in which the fuel elements may be immersed in a liquid coolant when desired without the necessity of removing them from the reactor structure. The fuel elements, containing the fissionable material are in plate form and are disposed within spaced slots in a moderator material, such as graphite to form the core. Adjacent the core is a tank containing the liquid coolant. The fuel elements are mounted in spaced relationship on a rotatable shaft which is located between the core and the tank so that by rotation of the shaft the fuel elements may be either inserted in the slots in the core to sustain a chain reaction or immersed in the coolant.

7022

METHOD OF SUSTAINING A NEUTRONIC CHAIN REACTING SYSTEM. E. Fermi and M. C. Leverett (to U. S. Atomic Energy Commission). U. S. Patent 2,813,070. Nov. 12, 1957.

This patent relates to neutronic reactors and a method of sustaining a chain reaction. The reactor shown in the patent for carrying out the method is the gas-cooled type comprised of a solid moderator having a plurality of passages therethrough for receiving bodies of fissionable material. In carrying out the method, the reactor is loaded by inserting in the passages fuel elements and moderator material in a proportion to sustain a chain reaction. As the reproduction ratio decreases below the desired figure due to impurities formed during operation of the reactor, the moderator material is gradually replaced with additional fuel material to maintain the reproduction ratio above unity.

7023

NEUTRON REACTOR FUEL ELEMENT UTILIZING ZIRCONIUM-BASE ALLOYS. H. A. Saller, J. R. Keeler and E. R. Szumachowski (to U. S. Atomic Energy Commission). U. S. Patent 2,813,073. Nov. 12, 1957.

This patent relates to clad fuel elements for use in neutronic reactors and is drawn to such a fuel element

which consists of a core of fissionable material, comprised of an alloy of zirconium and U^{235} enriched uranium, encased in a jacket of a binary zirconium-tin alloy in which the tin content ranges between 1 and 15% by weight.

7024

ELECTRON EMISSION REGULATING MEANS. I. R. Brenholdt (to U. S. Atomic Energy Commission). U. S. Patent 2,813,978. Nov. 19, 1957.

An electronic regulating system is described for controlling the electron emission of a cathode, for example, the cathode in a mass spectrometer. The system incorporates a transformer having a first secondary winding for the above-mentioned cathode and a second secondary winding for the above-mentioned cathode and a second secondary winding load by grid controlled vacuum tubes. A portion of the electron current emitted by the cathode is passed through a network which develops a feedback signal. The system arrangement is completed by using the feedback signal to control the vacuum tubes in the second secondary winding through a regulator tube. When a change in cathode emission occurs, the feedback signal acts to correct this change by adjusting the load on the transformer.

7025

APPARATUS FOR PRODUCING IONS OF VAPORIZABLE MATERIALS. C. Starr (to U. S. Atomic Energy Commission). U. S. Patent 2,813,979. Nov. 19, 1957.

This patent relates to electronic discharge devices used as ion sources, and in particular describes an ion source for application in a calutron. The source utilizes two cathodes disposed at opposite ends of a longitudinal opening in an arc block fed with vaporized material. A magnetic field is provided parallel to the length of the arc block opening. The electrons from the cathodes are directed through slits in collimating electrodes into the arc block parallel to the magnetic field and cause an arc discharge to occur between the cathodes, as the arc block and collimating electrodes are at a positive potential with respect to the cathode. The ions are withdrawn by suitable electrodes disposed opposite the arc block opening. When such an ion source is used in a calutron, an arc discharge of increased length may be utilized, thereby increasing the efficiency and economy of operation.

7026

FAST NEUTRONIC REACTOR. A. H. Snell (to U. S. Atomic Energy Commission). U. S. Patent 2,815,319. Dec. 3, 1957.

This patent relates to a reactor and process for carrying out a controlled fast neutron chain reaction. A cubical reactive mass, weighing at least 920 metric tons, of uranium metal containing predominantly U^{238} and having a U^{235} content of at least 7.63% is assembled and the maximum neutron reproduction ratio is limited to not substantially over 1.01 by insertion and removal of a varying amount of boron, the reactive mass being substantially freed of moderator.

7027

ISOTOPE CONVERSION DEVICE. E. P. Wigner, G. J. Young, and L. A. Ohlinger (to U. S. Atomic Energy Commission). U. S. Patent 2,815,321. Dec. 3, 1957.

This patent relates to nuclear reactors of the type utilizing a liquid fuel and designed to convert a non-thermally fissionable isotope to a thermally fissionable isotope by neutron absorption. A tank containing a reactive composition of a thermally fissionable isotope dispersed in a liquid moderator is disposed within an outer tank containing a slurry of a non-thermally fissionable isotope convertible to a thermally fissionable isotope by neutron absorption. A control rod is used to control the chain reaction in the reactive composition and means are provided for circulating and cooling the reactive composition and slurry in separate circuits.

7028

REACTOR CONTROL. W. J. Ruano (to U. S. Atomic Energy Commission). U. S. Patent 2,816,068. Dec. 10, 1957.

This patent relates to nuclear reactors of the type which utilize elongated rod type fuel elements immersed in a liquid moderator and shows a design whereby control of the chain reaction is obtained by varying the amount of moderator or reflector material. A central tank for containing liquid moderator and fuel elements immersed therein is disposed within a surrounding outer tank providing an annular space between the two tanks. This annular space is filled with liquid moderator which functions as a reflector to reflect neutrons back into the central reactor tank to increase the reproduction ratio. Means are provided for circulating and cooling the moderator material in both tanks and additional means are provided for controlling separately the volume of moderator in each tank, which latter means may be operated automatically by a neutron density monitoring device. The patent also shows an arrangement for controlling the chain reaction by injecting and varying an amount of poisoning material in the moderator used in the reflector portion of the reactor.

7029

HIGH SPEED CAMERA. B. T. Rogers, Jr. and W. C. Davis (to U. S. Atomic Energy Commission). U. S. Patent 2,816,476. Dec. 17, 1957.

This patent relates to high speed cameras having resolution times of less than one-tenth microseconds suitable for filming distinct sequences of a very fast event such as an explosion. This camera consists of a rotating mirror with reflecting surfaces on both sides, a narrow mirror acting as a slit in a focal plane shutter, various other mirror and lens systems as well as an image recording surface. The combination of the rotating mirrors and the slit mirror causes discrete, narrow, separate pictures to fall upon the film plane, thereby forming a moving image increment of the photographed event. Placing a reflecting surface on each side of the rotating mirror cancels the image velocity that one side of the rotating mirror would impart, so as a camera having this short a resolution time is thereby possible.

7030

MEANS FOR CONTROLLING A NUCLEAR REACTOR. V. C. Wilson, W. P. Overbeck, L. Slotin, and D. K. Froman (to U. S. Atomic Energy Commission). U. S. Patent 2,816,860. Dec. 17, 1957.

This patent relates to nuclear reactors of the type using a solid neutron absorbing material as a means for controlling the reproduction ratio of the system and thereby the power output. Elongated rods of neutron absorbing material, such as boron steel for example, are adapted to be inserted and removed from the core of the reactor by electronic motors and suitable drive means. The motors and drive means are controlled by means responsive to the neutron density, such as ionization chambers. The control system is designed to be responsive also to the rate of change in neutron density to automatically maintain the total power output at a substantially constant predetermined value. A safety rod means responsive to neutron density is also provided for keeping the power output below a predetermined maximum value at all times.

7031

SHOCK-EXCITED OSCILLATOR. R. Creveling (to U. S. Atomic Energy Commission). U. S. Patent 2,817,019. Dec. 17, 1957.

A shock-excited quartz crystal oscillator is described. The circuit was specifically designed for application in micro-time measuring work to provide an oscillator which immediately goes into oscillation upon receipt of a trigger pulse and abruptly ceases oscillation when a second pulse is received. To achieve the instant action, the crystal has a prestressing voltage applied across it. A monostable multivibrator receives the on and off trigger pulses and discharges a pulse through the crystal to initiate or terminate oscillation instantly.

7032

SPARK GAP SWITCH. R. B. Neal (to U. S. Atomic Energy Commission). U. S. Patent 2,817,036. Dec. 17, 1957.

An improved triggered spark gap switch is described, capable of precisely controllable firing time while switching very large amounts of power. The invention in general comprises three electrodes adjustably spaced and adapted to have a large potential impressed between the outer electrodes. The central electrode includes two separate elements electrically connected together and spaced apart to define a pair of spark gaps between the end electrodes. Means are provided to cause the gas flow in the switch to pass towards the central electrode, through a passage in each separate element, and out an exit disposed between the two separate central electrode elements in order to withdraw ions from the spark gap.

7033

NON-DESTRUCTIVE FLAW DETECTION APPARATUS. M. J. Stateman and H. R. Holloway (to U. S. Atomic Energy Commission). U. S. Patent 2,817,060. Dec. 17, 1957.

An apparatus is described for the non-destructive detection of flaws in electrical conducting articles. The particular feature of the detection apparatus is that a flaw in the front or back of the test article will not be masked by signals caused by the passage of the end and front of the article through the detection apparatus. The present invention alleviates the above problem by mounting detection coils on directly opposite sides of the test passageway so that the axes of the pickup coils are perpendicular to the axis of an energizing coil through which the article is passed. A flaw in the article will cause a change in the voltage induced in one pickup coil, but passage of the end or front of the article will not produce unequal signals. The signals are compared in appropriate electrical circuitry to actuate a recorder only when unequal signals are present, indicating the presence of a flaw.

7034

DEVICE FOR CONTROL OF OXYGEN PARTIAL PRESSURE. H. Bradner and H. S. Gordon (to U. S. Atomic Energy Commission). U. S. Patent 2,817,350. Dec. 24, 1957.

A device is described that can sense changes in oxygen partial pressure and cause a corresponding mechanical displacement sufficient to actuate meters, valves and similar devices. A piston and cylinder arrangement contains a charge of crystalline metal chelate pellets which have the peculiar property of responding to variations in the oxygen content of the ambient atmosphere by undergoing a change in dimension. A lever system amplifies the relative displacement of the piston in the cylinder, and actuates the controlled valving device. This partial pressure oxygen sensing device is useful in controlled chemical reactions or in respiratory devices such as the oxygen demand meters for high altitude aircraft.

7035

ION SOURCE FOR A CALUTRON. J. G. Backus (to U. S. Atomic Energy Commission). U. S. Patent 2,817,763. Dec. 24, 1957.

This patent relates to ion sources and more particularly describes an ion source for a calutron which has the advantage of efficient production of an ion beam and long operation time without recharging. The source comprises an arc block provided with an arc chamber connected to a plurality of series-connected charge chambers and means for heating the charge within the chambers. A cathode is disposed at one end of the arc chamber and enclosed by a vapor tight housing to protect the cathode. The arc discharge is set up between the cathode and the block due to a difference in potentials placed on these parts, and a magnetic field is aligned with the arc discharge. Cooling of the arc block is accomplished by passing coolant through a hollow stem secured at one end to the block and rotatably mounted at the other end through the wall of the calutron. The ions are removed through a slit in the arc chamber by accelerating electrodes.

7036

LOGARITHMIC AMPLIFIER. J. A. De Shong, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,818,504. Dec. 31, 1957.

A logarithmic current amplifier circuit having a high sensitivity and fast response is described. The inventor discovered the time constant of the input circuit of a system utilizing a feedback amplifier, ionization chamber, and a diode, is inversely proportional to the input current, and that the amplifier becomes unstable in amplifying signals in the upper frequency range when the amplifier's forward gain time constant equals the input circuit time constant. The described device incorporates impedance networks having low frequency response characteristic at various points in the circuit to change the forward gain of the amplifier at a rate of 0.7 of the gain magnitude for every two times increased in frequency. As a result of this improvement, the time constant of the input circuit is greatly reduced at high frequencies, and the amplifier response is increased.

7037

AUTOMATIC CALIBRATING SYSTEM FOR PRESSURE TRANSDUCERS. E. L. Amonette and G. W. Rodgers (to U. S. Atomic Energy Commission). U. S. Patent 2,818,726. Jan. 7, 1958.

An automatic system for calibrating a number of pressure transducers is described. The disclosed embodiment of the invention uses a mercurial manometer to measure the air pressure applied to the transducer. A servo system follows the top of the mercury column as the pressure is changed and operates an analog-to-digital converter. This converter furnishes electrical pulses, each representing an increment of pressure change, to a reversible counter. The transducer furnishes a signal at each calibration point, causing an electric typewriter and a card-punch machine to record the pressure at the instant as indicated by the counter. Another counter keeps track of the calibration points so that a number identifying each point is recorded with the corresponding pressure. A special relay control system controls the pressure trend and programs the sequential calibration of several transducers.

7038

ACCELERATION INTEGRATOR. K. E. Pope (to U. S. Atomic Energy Commission). U. S. Patent 2,819,053. Jan. 7, 1958.

This patent relates to an improved acceleration integrator and more particularly to apparatus of this nature which is gyrostabilized. The device may be used to sense the attainment by an airborne vehicle of a predetermined velocity or distance along a given vector path. In its broad aspects, the acceleration integrator utilizes a magnetized element rotatable driven by a synchronous motor and having a cylin-

drical flux gap and a restrained eddy-current drag cap deposed to move into the gap. The angular velocity imparted to the rotatable cap shaft is transmitted in a positive manner to the magnetized element through a servo feedback loop. The resultant angular velocity of the cap is proportional to the acceleration of the housing in this manner and means may be used to measure the velocity and operate switches at a pre-set magnitude. To make the above-described device sensitive to acceleration in only one direction the magnetized element forms the spinning inertia element of a free gyroscope, and the outer housing functions as a gimbal of a gyroscope.

7039

ELECTRONIC TRIGGER CIRCUIT. J. A. G. Russell (to U. S. Atomic Energy Commission). U. S. Patent 2,819,396. Jan. 7, 1958.

An electronic trigger circuit is described of the type where an output pulse is obtained only after an input voltage has equaled or exceeded a selected reference voltage. In general, the invention comprises a source of direct current reference voltage in series with an impedance and a diode rectifying element. An input pulse of preselected amplitude causes the diode to conduct and develop a signal across the impedance. The signal is delivered to an amplifier where an output pulse is produced and part of the output is fed back in a positive manner to the diode so that the amplifier produces a steep wave front trigger pulse at the output. The trigger point of the described circuit is not subject to variation due to the aging, etc., of multi-electrode tubes, since the diode circuit essentially determines the trigger point.

7040

APPARATUS FOR CONTROLLING THE POSITION OF AN ION BEAM IN A CALUTRON. E. O. Lawrence (to U. S. Atomic Energy Commission). U. S. Patent 2,819,401. Jan. 7, 1958.

This patent relates to improvements in electric discharge devices of the calutron type for separation of the isotopes of an element from the freely occurring composition. The improvement constitutes means for the continuous control of the path of an ion beam to obtain maximum reception in a receiver compartment. Withdrawal of the ions from the source is accomplished by an accelerator electrode placed at a positive potential with respect to the receiver. The ions are projected through a magnetic field perpendicular to the direction of motion towards a receiver. In order to obtain a signal representative of the magnitude of ions received from a particular ion beam in its compartment, an electrode is disposed in the compartment. The signal from the compartment electrode controls the voltage of the accelerating electrode through appropriate circuitry to maintain the path of the particular ion beam optimum for maximum ion current in the compartment.

7041

PHOTOSENSITIVE RELAY CONTROL CIRCUIT. C. F. Martin (to U. S. Atomic Energy Commission). U. S. Patent 2,820,182. Jan. 14, 1958.

A photoelectric system is described particularly adapted for the measurement of the time required for an oscillating member to pass through a preselected number of oscillations, after being damped to a certain maximum amplitude of oscillation. A mirror is attached to the moving member and directs light successively to a photocell which is part of a trigger unit and to first and second photocells which are part of a starter unit, as the member swings to its maximum amplitude. The starter and trigger units comprise thyratrons and relays so interconnected that the trigger circuit, although generating a counter pulse, does not register a count in the counter when the light traverses both photocells of the starter unit. When the amplitude of oscillation of the member decreases to where the second photocell is not transversed, the trigger pulse is received by the counter. The counter then operates to register the desired number of oscillations and initiates and terminates a timer for measuring the time interval for the preselected number of oscillations.

7042

TUBE TESTER. H. T. Gittings, Jr., and J. F. Kalbach (to U. S. Atomic Energy Commission). U. S. Patent 2,820,191. Jan. 14, 1958.

This patent relates to tube testing, and in particular describes a tube tester for automatic testing of a number of vacuum tubes while in service and as frequently as may be desired. In it broadest aspects the tube tester compares a particular tube with a standard tube through a difference amplifier. An unbalanced condition in the circuit of the latter produced by excessive deviation of the tube in its characteristics from standard actuates a switch mechanism stopping the testing cycle and indicating the defective tube.

7043

NUCLEAR REACTOR. H. I. Miller and R. C. Smith (to U. S. Atomic Energy Commission). U. S. Patent 2,820,753. Jan. 21, 1958.

This patent relates to nuclear reactors of the type which use a liquid fuel, such as a solution of uranyl sulfate in ordinary water which acts as the moderator. The reactor is comprised of a spherical vessel having a diameter of about 12 inches substantially surrounded by a reflector of beryllium oxide. Conventional control rods and safety rods are operated in slots in the reflector outside the vessel to control the operation of the reactor. An additional means for increasing the safety factor of the reactor by raising the ratio of delayed neutrons to prompt neutrons, is provided and consists of a soluble sulfate salt of beryllium dissolved in the liquid fuel in the proper proportion to obtain the result desired.

7044

PULSE HEIGHT ANALYZER. C. W. Johnstone (to U. S. Atomic Energy Commission). U. S. Patent 2,820,895. Jan. 21, 1958.

An anticoincidence device is described for a pair of adjacent channels of a multi-channel pulse height analyzer for preventing the lower channel from generating a count pulse in response to an input pulse when the input pulse has sufficient magnitude to reach the upper level channel. The anticoincidence circuit comprises a window amplifier, upper and lower level discriminators, and a biased-off amplifier. The output of the window amplifier is coupled to the inputs of the discriminators, the output of the upper level discriminator is connected to the resistance end of a series R-C network, the output of the lower level discriminator is coupled to the capacitance end of the R-C network, and the grid of the biased-off amplifier is coupled to the junction of the R-C network. In operation each discriminator produces a negative pulse output when the input pulse traverses its voltage setting. As a result of the connections to the R-C network, a trigger pulse will be sent to the biased-off amplifier when the incoming pulse level is sufficient to trigger only the lower level discriminator.

7045

MULTICHANNEL PULSE-HEIGHT ANALYZER. J. T. Russell and H. W. Lefevre (to U. S. Atomic Energy Commission). U. S. Patent 2,820,896. Jan. 21, 1958.

This patent deals with electronic computing circuits and more particularly to pulse-height analyzers used for classifying variable amplitude puises into groups of different

amplitudes. The device accomplishes this pulse allocation by by converting the pulses into frequencies corresponding to the amplitudes of the pulses, which frequencies are filtered in channels individually pretuned to a particular frequency and then detected and recorded in the responsive channel. This circuit substantially overcomes the disadvantages of prior analyzers incorporating discriminators pre-set to respond to certain voltage levels, since small variation in component values is not as critical to satisfactory circuit operation.

7046

APPARATUS FOR PRODUCING IONS OF VAPORIZABLE MATERIALS. B. T. Wright (to U. S. Atomic Energy Commission). U. S. Patent 2,821,632. Jan. 28, 1958.

A calutron ion source is described for the production of a uniform and copious supply of ions. The source comprises a hollow arc-block and means for establishing a magnetic field through the arc-block. Vaporization of the material to be ionized is produced by an electric heated filament. The arc producing structure within the arc-block consists of a cathode disposed between a pair of collimating electrodes along with an anode adjacent each collimating electrode on the side opposite the cathode. A positive potential applied to the anodes and collimating electrodes, with respect to the cathode, and the magnetic field act to accelerate the electrons from the cathode through a slit in each collimating electrode towards the respective anode. In this manner a pair of collinear arc discharges are produced in the gas region which can be tapped for an abundant supply of ions of the material being analyzed.

7047

ION SOURCE. W. A. Bell, Jr., L. O. Love, and W. K. Prater (to U. S. Atomic Energy Commission). U. S. Patent 2,821,662. Jan. 28, 1958.

An ion source is presented capable of producing ions of elements which vaporize only at exceedingly high temperatures, i.e., −1500 degrees to 3000°C. The ion source utilizes beams of electrons focused into a first chamber housing the material to be ionized to heat the material and thereby cause it to vaporize. An adjacent second chamber receives the vaporized material through an interconnecting passage, and ionization of the vaporized material occurs in this chamber. The ionization action is produced by an arc discharge sustained between a second electron emitting filament and the walls of the chamber which are at different potentials. The resultant ionized material egresses from a passageway in the second chamber. Using this device, materials which in the past could not be processed in mass spectrometers may be satisfactorily ionized for such applications.

7048

LIQUID HOMOGENEOUS REACTOR SAFETY OVERFLOW SYSTEM. I. F. Weeks (to North American Aviation Inc.). British Patent 783,400. Nuclear Eng. 3, No. 24, 136(1958) Mar.

A safety device is described for preventing radioactive contamination of the surrounding area by solution expansion and overflow during a reactor runaway. To entrap the surge overflow from the core the core container is connected to an accumulator of size such that the ratio of volume of the accumulator to the volume of the core container is greater than the ratio of the excess of fissionable material in the container (over the critical mass) to the total mass of fissionable material in the container. The overflow is physically separated from the solution in the core container, so that two subcritical masses of fissionable material are obtained.

7049

PROCESS AND APPARATUS FOR CARRYING OUT NUCLEAR FISSION REACTIONS. (to Stitching Reactor Centrum Nederland (Netherlands)). British Patent 783,985. Nuclear Eng. 3, No. 24, 136(1958) Mar.

It is difficult to control the concentration of nuclear fuel suspensions in all parts of the reaction vessel in reactors working with solid fissile material in a carrier liquid. These difficulties are caused by the high specific gravity of the fissile material (natural or enriched uranium oxides) and the necessary high-temperature level in the heat exchanger, which means low viscosity of the carrier liquid promoting rapid settling of the fuel. These difficulties can be overcome if turbulence of the suspension is avoided while descending through the reactor vessel. Therefore, the vessel is so designed that the suspension is conducted by a vertical passage or passages of uniform cross-section in laminar flow and the fissile material enters continuously the passage or passages in such concentrations in the carrier liquid that the concentration of the suspension considered along any vertical flow line within the passages is uniform. This means that the concentration may vary horizontally but is vertically constant at any place across the vessel.

7050

NUCLEAR REACTORS. E. Long and J. W. Ashley (to U. K. Atomic Energy Authority). British Patent 784,291. Nuclear Eng. 3, No. 24, 136(1958) Mar.

A moderator structure is described having regard to Wigner growth (see Nuclear Engineering, December, 1957, pages 527/528).

7051

MODERATOR STRUCTURES FOR NUCLEAR REACTORS. E. Long and J. W. Ashley (to U. K. Atomic Energy Authority). British Patent 784,292. Nuclear Eng. 3, No. 24, 136(1958) Mar.

(See above and also Nuclear Engineering, December, 1957, pages 527/528.)

7052

ELECTROSCOPES AND GLAND SEA'S THEREFOR. D. F. Burnett (to Rank Precision Industries, Ltd.). British Patent 784,315. Nuclear Eng. 3, No. 24, 136(1958).

Portable (pocket) instruments are described for, e.g., measuring gamma or x-radiation dosages. A reciprocal spring-loaded charging sleeve also loads a ring gland seal surrounding the sleeve, so as automatically to compensate for any relaxation of the seal.

7053

ELECTROSCOPES AND CHARGING MECHANISMS THEREFOR. D. F. Burnett (to Rank Precision Industries, Ltd.). British Patent 784,316. Nuclear Eng. 3, No. 24, 136(1958) Mar.

Provision of an earthing resistance connected to the moving member of the charging switch in the retracted position of the switch eliminates short circuiting.

7054

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. H. H. L. Ritz (to C. A. Parsons & Co., Ltd.). British Patent 785,886. Mar. 17, 1955. Nuclear Power 3, 142(1958) Mar.

A method of removing heat from a reactor core with no fluid actually flowing through it is the subject of this invention. The advantages of this are that the power required for coolant circulation can be reduced and the temperature difference between the fuel and the heat transfer medium can be made very small. The fuel element is contained in a sealed cylindrical can which is also partly filled with an in-

termediate heat transfer fluid. The top end of the can extends right out of the core into a heat exchanger through which the main coolant such as water or liquid metal circulates. The intermediate liquid has a critical temperature slightly higher than the temperature to which the coolant is to be raised but lower than that of the maximum permissible fuel temperature. If the ratio of the volume of liquid in the tube to the total volume of the tube is at least equal to the ratio of the specific volume of the liquid at atmospheric conditions to its critical volume, the pressure and temperature of the fluid in the tube tend to assume simultaneously their critical values. The effect of this is good heat transfer from fuel to coolant through the intermediate fluid in the critical or near critical stage. (auth)

7055

IMPROVEMENTS IN OR RELATING TO NUT AND SCREW MECHANISMS. J. A. F. Glass (to United Kingdom Atomic Energy Authority). British Patent 786,486. May 11, 1954. Nuclear Power 3, 142(1958) Mar.

In the published descriptions of the Dounreay Fast Reactor it was not made particularly clear how the reactivity control system operates because the information was withheld by the AEA at the time. Now a patent is published which seems to suggest how it is done. As disclosed last year, control of the DFR is by withdrawal from below the unmoderated core of certain fuel elements, the mechanism for doing this being partly immersed in the molten sodium primary coolant. The object of this invention, one form of which is probably used at Dounreay, is to provide in one unit both fine control and emergency control and the specification describes a nut and screw mechanism driven through a magnetic clutch. Fine control is obtained by moving the fissionable material into or out of the core by the screw mechanism. When scram action is required, deenergizing the clutch sends the movable elements out of the core under gravity. The invention makes use of a 'ball-bearing' thread (British Patent 707,D17). (auth)

7056

IMPROVEMENT IN OR RELATING TO NUCLEAR REACTORS. (to Stichting Reactor Centrum, Netherland). British Patent 788,284. July 16, 1956. Nuclear Power 3, 142(1958) Mar.

Solid homogeneous reactors incorporating fissionable and moderating material in an intimate porous mixture have been receiving a good deal of attention lately and this Dutch invention suggests one way in which the materials can be arranged. The invention however also relates to heterogeneous reactors in which heat distributing material can be mixed with the fuel. It is proposed to manufacture the homogeneous material—which may be in the form of metals or their compounds, provided that chemical compatability is assured—in the form of a porous mass fabricated into shapes such as packing units, perforated blocks or spheres, plates, rods or tubes. If gas is used as a coolant it is recommended that a voidage of 50% is allowed between the packing units to minimize pressure loss. If the packing material contains oxides, the gas should be CO_2 with a small percentage of O_2: if carbides or graphite are used, CO with possibly a little CO_2 could be used. Other suggested gases are He, H, or D and vapors and liquids are also considered as possible coolants. Methods of preparing the porous materials are outlined at some length in the specification. (auth)

7057

IMPROVEMENTS IN OR RELATING TO FUEL ELEMENTS FOR NUCLEAR REACTORS. W. B. Hall and T. Davis (to United Kingdom Atomic Energy Authority). British Patent 789,257. Nov. 5, 1955. Nuclear Power 3, 142(1958) Mar.

It is a known fact that as heat ratings in gas-cooled reactors increase, the optimum fin height on the fuel elements becomes shorter and shorter. Here is a glimpse of a possible advanced type of fuel element for a gas cooled reactor of high heat-rating. The inventors say that as the need for deep finning is reduced, so it becomes possible to consider accepting fuel element sheath materials having a reduced thermal conductivity and an increased neutron absorption so long as compensating advantages such as improved mechanical properties at high temperatures are obtained. One possibility is stainless steel. One form of element designed accordingly is described. The 'fins' are frustoconical in shape which give the element a different heat transfer performance according to which way up it is installed in the fuel channel. It is proposed to make these elements by casting the bar roughly to shape and then machining it. The sheath, in cylindrical form, would be slipped over the uranium bar and then rolled on to shape. End fittings are similar to those used at Calder but could obviously be adapted to particular needs. To increase turbulence, the sheath surface can be roughened and rings can be inserted in the channel. Another type of element to achieve the same object is also described. (auth)